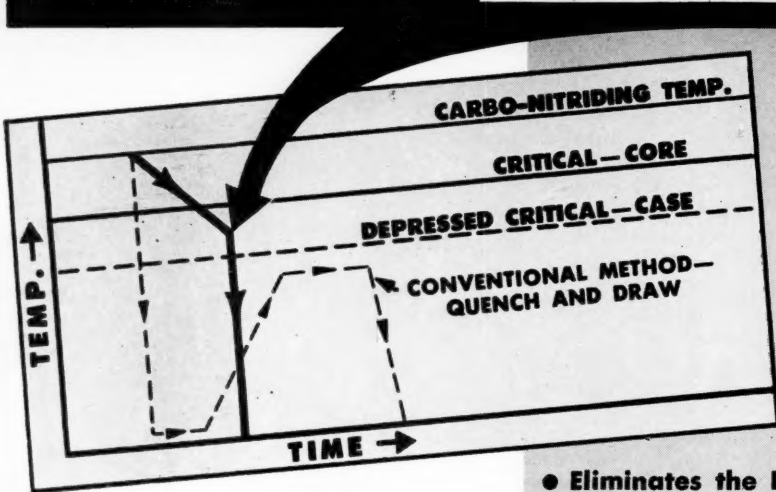
Metals Review

THE NEWS DIGEST MAGAZINE

VOLUME XXI—No. 7 This Month: Heat Treatment JULY, 1948

Quenching *BELOW THE CRITICAL*



A *New* CASE-HARDENING TECHNIQUE WHICH

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- **Cuts Distortion to a New Low**
- **Saves Time, Money and Floor Space**

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Metals Review

THE NEWS DIGEST MAGAZINE

RAY T. BAYLESS, Publishing Director — MARJORIE R. HYSLOP, Editor — GEORGE H. LOUGHNER, Production Manager

VOLUME XXI, No. 7 — **JULY, 1948**

A.S.M. REVIEW OF METAL LITERATURE

HEAT TREATING SECTION

NEWS AND LECTURES

DEPARTMENTS

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ANNOUNCING THE

Third ASM Metallographic Exhibit

to be held at the National Metal Congress and Exposition in Philadelphia, Oct. 25 to 29, 1948. Rules are simple and few; there are no restrictions as to size or method of mounting. A large area in the exhibition hall has been reserved so the entries can be displayed to best advantage.

RULES FOR ENTRANTS

Work which has appeared in previous Metallographic Exhibits is unacceptable.

Photographic prints shall be mounted on stiff cardboard, each on a separate mount. Each shall carry a label giving
Name of metallographer
Classification of entry
Material, etchant, magnification
Any special information as desired

Transparencies or other items to be viewed by transmitted light must be mounted on light-tight boxes wired for plugging into an ordinary lighting circuit, and built so they can be fixed to the wall.

Exhibits must be delivered between Oct. 1 and Oct. 20, 1948, preferably by prepaid express or registered parcel post.

Address:
Metallographic Exhibit,
c/o W. H. Eisenman
National Metal Congress and Exposition
Commercial Museum
34th, below Spruce,
Philadelphia, Pa.

CLASSIFICATION OF MICROGRAPHS

1. Cast Irons and Cast Steels
2. Toolsteels (except carbides)
3. Irons and Alloy Steels (excluding stainless)
4. Stainless and Heat Resisting Steels and Alloys
5. Light Metals and Alloys
6. Heavy Nonferrous Metals and Alloys
7. Powder Metals (and carbides) and Compacts
8. Weld Structures (including brazed and similar joints)
9. Surface Phenomena (including corrosion products and electroplates)
10. Series of Micros showing Transitions or Changes During Processing
11. Macrographs of Metallurgical Objects or Operations (2 to 10 diam.)
12. Results by Non-Optical or other Unconventional Techniques.

AWARDS AND OTHER INFORMATION

A committee of judges will be appointed by the Metal Congress management which will award a first prize (a blue ribbon) to the best in each classification. Honorable Mentions will also be awarded other photographs which in the opinion of the judges closely approach the winner in excellence.

A Grand Prize, in the form of an engrossed certificate, and a money award of $50 will be awarded the exhibitor whose work is adjudged "best in the show", and his exhibit shall become the property of the American Society for Metals for preservation and display in the Sauveur Room at the Society's Headquarters.

The Society reserves the right to retain all prize-winning micrographs for six months for a traveling exhibit to Chapters. All other exhibits will be returned to owners by prepaid express or registered parcel post during the week of Nov. 1, 1948. Entrants living outside the U. S. A. will do well to send micros by first-class letter mail endorsed "May be opened for Customs inspection before delivery to addressee".

30th NATIONAL METAL CONGRESS

COMMERCIAL MUSEUM, PHILADELPHIA

October 25 to 29, 1948

Fundamentals Behind Heat Treating Operations

Development of a Mental Picture of the Mechanical Structures Inside of Steel

By Chester M. Inman

WHEN we speak of steel what sort of a mental picture is formed in your mind? Do you think of the finish on the bar, the method of manufacture, of the carbon content, or of the alloying elements? What do the terms "annealed" or "heat treated" mean to you, other than that the steel is either in a soft state or has been quenched and tempered? Do you realize that a piece of steel is not simply a hunk of metal but has an internal anatomy capable of immense physical and mechanical changes? A mental picture of the internal structure of steel under various conditions of heat treatment will lead to a better understanding of what goes on in the working of steel.

The common shop terms for various kinds of steel, as well as the modern designation of steel by analysis, do not help in forming a picture of the internal structure. Many shop terms in common use today are relics of past times when there were only a few simple carbon and alloy steels. Such terms as hot rolled, cold rolled, shafting, drill rod, all refer to the type of finish which may be applied to steel of any chemical analysis. The terms openhearth steel, bessemer steel, and electric furnace steel refer only to the methods of production. Such terms as soft steel, machine or machinery steel, screw stock, boiler plate, flange steel usually refer to low-carbon steel but are insufficient descriptions of the material for exacting work. With the many alloy steels on the market today, to specify nickel steel or a chrome-vanadium steel means nothing unless the full analysis is given.

Much care should be taken in using abbreviations. For instance, C. R. may mean to one person cold rolled steel; to another corrosion resisting steel. Again, O. H. may mean open hearth steel, or oil hardening steel.

The general method of ordering steel has been by chemical analysis and method of manufacture. Standard analyses have been adopted, such as the S.A.E., A.I.S.I., and N.E. specifications.

Actually, these standard analyses do not fully cover the steel specifications, for many of the steels may be furnished with different inherent characteristics although of the same chemical analysis. However, all steels are governed by the fundamental mechanical changes which occur upon heating and cooling.

For many years it has been the opinion of a number of the members of the Worcester Chapter of the American Society for Metals that the majority of the talks and written publications on steel have been of too technical a nature for the practical man to apply to his everyday problems in the working of steel. Furthermore, there is considerable misunderstanding regarding shop terms, the physical properties of steel, the importance of design and good machining practice, and the effect of alloys.

For these reasons a committee was named, composed of metallurgists, practical heat treaters, and shopmen, to present modern information on steel which would be helpful to the practical man. A course of three lectures on "The Working of Steel" written by Chester M. Inman was the result.

This committee believed it would be possible to show that it is the internal structure of the steel which determines its physical properties, its machining and forming qualities. This internal structure is actually a mechanical structure and so the working of steel becomes a mechanical problem.

A picture of this internal structure, and how it is affected by heat treatment, is given in this lecture, first in the series of three.

The chemical analyses, as specified, show the main elements with the exception of the iron content, so the important fact that we are dealing mainly with iron is often lost sight of. A high-carbon tool steel contains over 98% iron and even highly alloyed 18-4-1 high speed steel contains about 75% iron.

Steel is essentially an alloy of carbon and iron. The practical value of steel lies in the fact that by heat treatment a large range of physical properties may be produced; in unalloyed iron, on the other hand, very little change occurs.

For instance, a high-carbon tool steel, containing only 1% (100 points) carbon, in the as-rolled condition, is too hard for easy machining and not hard enough to be of use as a cutting tool. By proper heating and slow cooling, the steel is annealed for easy machining. Then it is heated again, quenched and tempered to make a hard, tough tool. In all three conditions—as-rolled, annealed or hardened—nothing has been added or taken away from the chemical analysis of the steel, and yet we have an entirely different material with respect to physical properties.

With the aid of the high-powered microscope we can take pictures of specimens and note the internal structure, which changes under different conditions of heating and cooling. The microscope shows that the steel is composed of grains or crystals which, by heat treatment, can be refined to a small size or made to grow larger at the will of the heat treater. Within these grains there is a definite pattern of a mechanical structure that depends on the rate of cooling (but always tends to reach a stable condition). Alloys do not change the fundamental pattern of the physical anatomy of the steel as it transforms on heating or cooling, but only serve to heighten some of the properties already inherent in the steel and to change the temperatures at which these changes take place.

The physical properties of iron alone can be only slightly changed by heat treatment, but when alloyed with carbon, the tensile strength can

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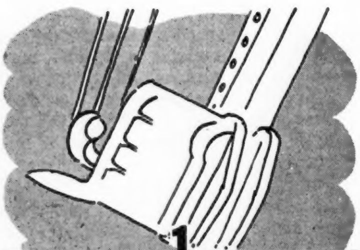
A. S. M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received in the Library of Battelle Memorial Institute, Columbus, Ohio, During the Past Month



1 ORE BENEFICIATION

1a—General

1a-17. Toward Decreased Ball Wear. *Engineering and Mining Journal,* v. 149, May 1948, p. 90-91.

It was found that wear first increases and then decreases as grinding time increases and the product gets finer. It is believed that more rapid elimination of finer sizes will result in reduction of ball wear.

1a-18. Ability of Solid Substances to Respond to Flotation; Flotation Relationships. (In Russian.) Z. V. Volkova. *Zhurnal Fizicheskoi Khimii,* (Journal of Physical Chemistry), v. 22, Jan. 1948, p. 121-128.

A formula for determination of the probability of the mineralization of air bubbles. This probability is a function of the average volume of the bubbles. It reaches a maximum for a certain bubble volume, and then decreases to zero for maximum bubble volume. The higher the value of the function, and the wider the range of volumes between the maximum volume and maximum function, the higher the ability to be floated.

1b—Ferrous

1b-10. U. S. Steel Pushes Ore Research. *Iron and Steel Engineer,* v. 25, May 1948, p. 92-93.

Laboratory and facilities of Oliver Ore Mining Co.

1b-11. Concentratability of Birmingham, Ala., Red Iron Ores by Separation in Heavy Media. B. H. Clemmons, R. H. Stacy, and B. G. Saunders. *Bureau of Mines, Report of Investigations* No. 4249, May 1948, 45 pages.

On the basis of the data presented, it is apparent that red iron ore from a number of the mines in the Birmingham area can be significantly improved in grade by heavy-medium treatment. Cost analysis. 14 ref.

1b-12. Shasta and California Iron-Ore Deposits; Shasta County, Calif. John R. Shattuck and Spangler Ricker. *Bureau of Mines, Report of Investigations* No. 4272, May 1948, 11 pages.

Description of deposits; results of preliminary sink-float, jig, table, and magnetic concentrator tests.

1b-13. The Ore-Preparation Plant at the Workington Branch of the United Steel Companies, Ltd. *Journal of the Iron and Steel Institute,* v. 159, May 1948, p. 73-76.

1c—Nonferrous

1c-38. Theory of Metal Precipitation From Solutions by Means of Metallic Precipitating Agents. (In Russian.) I. N. Plaksin, N. A. Suvorovskaya, and O. K. Budnikova. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences), Jan. 1948, p. 131-138.

The influence of physicochemical factors such as solution temperature, intensity of stirring, and presence of different impurities on the precipitation of gold from cyanide solution by metallic Zn.

1c-39. San Francisco del Oro Metallurgy. *Mining World,* v. 10, May 1948, p. 16-18.

Method used to separate bulk concentrate into Pb and Cu concentrates by use of SO_2.

1c-40. La Métallurgie du Cuivre au Katanga. (The Metallurgy of Katanga Copper.) Maurice Rey. *Review de Métallurgie,* v. 44, Sept.-Oct. 1947, p. 261-266.

Brief history of the area and its geology; and the extraction and reduction methods used in obtaining copper along with cobalt, tin, gold, and palladium.

1c-41. Laboratory Concentration of Complex Sulphide-Oxide Ore From Shenandoah-Dives Mine, Silverton, Colo. Heine Kenworthy. *Bureau of Mines, Report of Investigations* No. 4283, May 1948, 16 pages.

Results obtained in a laboratory investigation of an ore in which a mixture of clean sulphide and semi-oxidized material proved difficult to treat. Pb, Zn, Cu, Au, and Ag are recovered.

1c-42. Milling Practice at Idarado Mining Company. F. W. McQuiston. *Mining Technology,* v. 12, May 1948, T.P. 2349, 6 pages.

Company recovers Ag, Au, Cu, Pb, and Zn from a compound fissure vein which has undergone several stages of mineralization. Flotation procedure, in which the major metallurgical problem is promotion of chalcopyrite in the presence of Zn and Fe depressants.

1c-43. Metallurgy at National Lead Co., MacIntyre Development. Frank R. Milliken. *Mining Technology,* v. 12, May 1948, T.P. 2355, 14 pages.

Metallurgical problems and developments, stressing ilmenite flotation. Five ore types are present: high and low-grade anorthosite ore; high-grade coarse-grained and fine-grained gabbro ore; and disseminated or low-grade gabbro ore.

1c-44. Flotation of Low-Grade Gold Ores at Golden Cycle Corp. Howard R. Keil. *Mining Technology,* v. 12, May 1948, T.P. 2361, 5 pages.

The gold ores from the Cripple Creek district are the highly siliceous sulfotellurides with approximately 3% total sulfides. These ores required a type of flotation machine that would give a rather violent aeration and agitation, which produced a fairly deep froth column containing not only the free mineral, principally pyrite, but also most of the middling product. The Fagergren type proved satisfactory.

1c-45. A Method for Adapting the Ammonia-Leaching Process to the Recovery of Copper and Nickel From Sulphide Ore and Concentrate. F. A. Forward, C. S. Samis, and V. Kudryk. *Canadian Mining and Metallurgical Bulletin,* v. 4, (*Transactions,* v. 51), June 1948, p. 250-355.

Principal steps in the process, procedure, and tables of results.

1c-46. Metallurgical Improvements in the Treatment of Copper-Nickel Ores. P. E. Queneau. *Canadian Mining and Metallurgical Bulletin,* v. 41, (*Transactions, v.* 51), June 1948, p. 356-367.

Improvements which have been introduced during recent years in the plants of the International Nickel Company of Canada, Ltd. Concentrator, smelter, Cu refinery and Ni refinery procedures.

1c-47. The Development of Copper Production at Mount Lyell. S. G. Salamy. *Mine & Quarry Engineering,* v. 14. June 1948, p. 169-174.

Geological and historical aspects of subject; flowsheets of concentration and smelting. Mining, crushing, grinding, flotation, smelting, and refining operations.

For additional annotations indexed in other sections, see:
27c-13.

2 SMELTING, REDUCTION and REFINING

2a—General

2a-8. Les Applications du Vide dans la Métallurgie. (Applications of Vacuum in Metallurgy.) L. Colombier. *Revue de Métallurgie,* v. 44, Nov.-Dec. 1947, p. 374-379; discussion, p. 379.

Development of vacuum smelting and casting. Applications of vacuum smelting and casting.

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HEAT TREAT FUNDAMENTALS

be varied from approximately 50,000 psi. to over 300,000 psi. This large range of physical strength is based on the fact that the iron part (or constituent) of the steel undergoes some remarkable changes each time the steel is heated above or cooled below a temperature somewhat above a red heat, called the critical temperature. The actual temperatures at which these changes take place are mainly dependent upon the chemical analysis of the steel, so it is important to know the critical temperatures on heating and cooling for each grade of steel.

Actually, in the heat treatment of steel we are dealing with two entirely different kinds of iron, each kind having its own inherent properties. One is the low-temperature form of iron, which has a 9-atom body-centered system (as shown by X-rays), and the other is the high-temperature form of iron, which has a 14-atom face-centered system. During the vast upheaval of the atoms to rearrange themselves during the transformation from the low-temperature type of iron to the high-temperature type, the steel recrystallizes to a small grain size each time it is heated to above the critical temperature. These grains tend to grow as the temperature is raised or as the time the steel is held above the critical temperature is longer. On cooling below the critical temperature, the grain size formed at the high temperature becomes established and does not change unless distorted by cold work, or unless the steel is again heated to above the critical, and fine grains are again produced

In other words, on heating steel to *just* above the critical temperature and then cooling by any method, a fine-grained, relatively tough structure will be obtained. If the steel is heated to *considerably* above the critical, a coarse-grained, relatively brittle structure will be produced. The control possible in establishing the desired grain size (and so determining the physical properties of the steel) is of value both in machining and in hardening. A structure of coarse grains is generally desirable for rough and heavy machining, while for high-speed, light finishing cuts a structure of fine grains generally gives superior results. Likewise, in hardening, the depth of the hardened structure is greater as the grain is coarsened, but the steel also becomes more brittle and the actual Rockwell hardness may be less.

The most important property of the high-temperature iron is that, even though it is a solid, it acts like a liquid and possesses the power to absorb most of the alloying elements. All heat treating processes start from the high-temperature form of iron, where the aim is to absorb the alloying elements (with certain exceptions) into a uniform solution. As the steel is cooled past the critical temperature, the low-temperature iron forms and tends to throw out of solution certain of the alloying elements. The structural pattern within the grains is primarily based on the way in which the carbon in the steel unites with the iron as it is thrown out of solution.

The carbon and the iron combine in a definite chemical manner to form a very hard and brittle carbide having an estimated Brinell hardness of 680 to 840. The shape and manner of distribution of this hard carbide in the low-temperature form of the steel depend on the amount of carbon in the steel and on the rate of cooling.

On normal air cooling to below the critical temperature, the tendency of the low-temperature iron is to throw the carbides out of solution and thus reach a stable condition. In so doing, the carbides form alternate layers or laminations with a definite amount of practically carbon-free iron. While the carbide contains 6.68% carbon by weight, an analysis of the composite laminated structure for straight carbon steels shows approximately 0.85% carbon content. Thus, for straight carbon steels, when the chemical analysis of the bar material is 0.85% carbon, the entire mechanical structure within the grains (when the steel is air cooled from above the critical temperature) will be composed of this laminated plate structure.

If the analysis of the bar material is less than 0.85% carbon, the mechanical structure inside the grains will be composed of areas of this laminated composite within a matrix of carbon-free iron. If the carbon is more than 0.85%, the grains will be entirely composed of the laminated structure with the excess carbide forming a network at the grain boundaries, and the grains appear to be cemented together. For this reason the carbide was given the name of cementite. The laminated structure of cementite and iron is called pearlite. The low-temperature form of iron—that is, the matrix holding the laminated pearlitic structure—is called ferrite (from ferrous, meaning iron).

As may be imagined, if the grain is wholly composed of the laminated plate structure, machining would be rather difficult, whereas if only a portion of the grain is composed of this pearlitic structure, a tool is able to do good work by pushing the hard areas aside. For this reason carbon steels of about 0.55% carbon or over, and alloy steels of about 0.35% carbon or over, are generally annealed before machining (cooled very slowly from above the critical temperature). Annealing tends to coagulate the hard carbide plates into a more stable structure of a globular or spheroidized nature. Special anneals will entirely spheroidize the cementite.

Material in the spheroidized form will stand more cold forming than steel with the cementite in the laminated state, but will act gummy for machining unless sufficient carbides are present. High-carbon steel is more readily machined in the spheroidized condition, medium-carbon steel in the laminated pearlitic condition, whereas low-carbon steels, being mainly soft, ductile ferrite, are mean steels to machine to a fine finish unless purposely made free cutting in the process of manufacture by the addition of sulphur or lead.

In the process known as hardening, the steel is heated above its critical temperature so as to produce the high-temperature form of steel (called austenite). Then it must be quenched at a rate fast enough to prevent the carbides from coming out of solution to form a pearlitic structure. If pearlite is prevented from forming, we have a highly strained needle-like structure within the grains, known as martensite. Its Brinell hardness is about 720 (Rockwell C-66).

As the steel is then progressively tempered (reheated to temperatures below its critical) two important things occur. First, the immense internal strains set up in the steel by the hardening operation are continuously reduced. Second, a very fine dispersion of the carbide begins to appear and, as these cementitic globular particles coagulate and grow, the carbon content of the matrix is reduced and the matrix becomes softer. One of the chief functions of the alloying elements is to develop the fully hardened martensitic structure to greater depths in large section than is possible with straight carbon steels. Partially hardened material contains transformed areas, within the martensite, of the much weaker though very fine lamellar pearlite structure.

The secret of the physical properties of steel—with certain exceptions to be explained in a later lecture—lies in the development of the mechanical structure desired. It has been our endeavor thus far to explain the different mechanical structures that can be produced by heat treatment so as to lay a foundation for a mental picture of the inside of steel. With such a mental picture the working of steel becomes a problem of how to work the mechanical structure that has been established to the best advantage or how to heat treat

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2b—Ferrous

2b-112. Das Aplicacoes co Forno Eléctrico de Inducao a Baixa Frequência na Fundicao do Ferro. (Application of Electric Low-Frequency Induction of Furnace for Iron Smelting.) Hildebrando Américo Werneck. *Boletim da Associacao Brasileira de Metais,* v. 4, Jan. 1948, p. 5-28.

The above is studied with particular respect to Brazilian conditions and to three principal factors: energy consumption, cost of production, and a duplex method using a cupola furnace in combination with a low-frequency induction furnace.

2b-113. Sobre o Desenvolvimento da Sinterizacao e o Emprego de Minérios de Ferro Sinterizados na Suécia. (Development of Sintering and Utilization of Sintered Iron Ores in Sweden.) Erik Brauns. *Boletim da Associacao Brasileira de Metais,* v. 4. Jan. 1948, p. 29-35.

2b-114. Progress in High Pressure Operations of Blast Furnaces. B. S. Old, E. L. Pepper, and E. R. Poor. *Iron and Steel Engineer,* v. 25, May 1948, p. 37-43; discussion, p. 43-47.

Experience obtained from operation of two blast furnaces under high top pressure has resulted in the development of a number of mechanical improvements which have reduced delays to a point equivalent to that on a normal-pressure furnace. (Presented at A.I.S.E. annual convention, Pittsburgh, Sept. 25, 1947.)

2b-115. Agitation of the Bath With Compressed Air in the Liquid Metal Process. Oscar Pearson. *Iron and Steel Engineer,* v. 25, May 1948, p. 59.

2b-116. Use of Oxygen and Compressed Air in the Openhearth. M. F. Yarotsky. *Iron and Steel Engineer,* v. 25, May 1948, p. 59.

2b-117. Les Premiers Resultats de l'Emploi de l'Oxygene dans les Acieries. (The Primary Results of the Use of Oxygen in Steelmaking Furnaces.) Frank Kerry. *Revue de Métallurgie,* v. 44, Sept.-Oct. 1947, p. 278-285.

Results of a series of studies in Canada and the U. S. on the use of oxygen in openhearth furnaces.

2b-118. Zur Kenntnis der Reduktion von Eisenoxyden mit Wasserstoff und Kohlenmonoxyd. (Reduction of Iron Oxides by Means of Hydrogen and Carbon Monoxide.) (Concluded.) H. J. Leibu. *Schweizer Archiv fur angewandte Wissenschaft und Technik,* v. 14, March 1948, p. 76-85.

The effect of magnesium, silicon, aluminum, and calcium oxides on the reduction of a certain German ore.

2b-119. Manufacture of Sponge Iron in Ceramic Tunnel Kilns. V. H. Gottschalk. E. S. Beebe, and Richard S. Cole. *Bureau of Mines, Report of Investigations* No. 4271, April 1948, 25 pages.

Sponge iron manufactured at oldest plant in Hoeganaes, Sweden, is most satisfactory. Experimental study of process including cost analysis.

2b-120. Mold Consumption; The Influence of Mold-Weight to Ingot-Weight Ratio. N. H. Bacon. *Iron and Steel,* v. 21, May 13, 1948, p. 251-255, Discussion p. 275-276.

Data from three sources. Data on octagon molds and molds with superimposed feeder heads.

2b-121. Ingot Surface Defects; "Double Skin" or "Curtaining" on Top-Poured Mild-Steel Ingots. P. Walker. *Iron and Steel,* v. 21, May 13, 1948, p. 256-257; Discussion, p. 275-276.

Previously abstracted from *Journal of the Iron and Steel Institute,* v. 158, Jan. 1948, p. 96-98. See item 2b-35, 1948.

2b-122. Blast Variations Seriously Affect Cupola Operations. B. P. Mulcahy. *American Foundryman,* v. 13, June 1948, p. 34-42.

Importance of factor and recommended design procedures, including proper installation of air meters. Effects of various factors on the amounts of air required.

2b-123. Steelmaking in Acid Side-Blown Converters. Norman F. Dufty. *Blast Furnace and Steel Plant,* v. 36, June 1948, p. 683-690, 751.

Practice at British works, and a theory of reactions involved. 10 ref.

2b-124. Practices Affecting Yields and Surface Quality of Rimmed and Semi-killed Steel. Part II. Leo R. Silliman. *Blast Furnace and Steel Plant,* v. 36, June 1948, p. 691-694.

Relationship of pouring temperatures to semifinished yield; ingot-top condition and washed surface to semifinished yields; and ingot delivery time to yield loss due to slag pipe. (Concluded.)

2b-125. The Use of Blown Metal in Openhearth Steelmaking. H. B. Emerick. *Blast Furnace and Steel Plant,* v. 36, June 1948, p. 695-696.

All-liquid-charge duplex process operated with acid converters and tilting basic openhearths. In this process, some portion of the charge, usually between 30 and 70%, is desiliconized blown-metal of variable carbon content; the remainder of the charge comprises liquid iron and scrap, or scrap alone.

2b-126. Effect of Coke Quality on Blast Furnace Iron Tonnage. E. J. Gardner. *Blast Furnace and Steel Plant,* v. 36, June 1948, p. 707-711.

A definite change in coking quality of high or low-volatile coal used in the blend produces a definite change in physical and chemical properties of resulting coke.

2c—Nonferrous

2c-31. L'Analyse Thermodynamique du Systeme $2Cu+H_2O \rightleftharpoons Cu_2O+2H$. (Thermodynamic Analysis of the System $2Cu + H_2O \rightleftharpoons Cu_2O + 2H$.) M. H. Lepp. *Revue de Métallurgie,* v. 44, Sept.-Oct. 1947, p. 271-277; discussion, p. 277.

Largely based on data from the literature. Absorption of hydrogen on copper; thermal dissociation of Cu_2O; thermal dissociation of water vapor; and the system $4\ Cu+ H_2O \rightleftharpoons Cu_2O+2\ CuH$. The importance of these values in the refining of copper. 13 ref.

2d—Light Metals

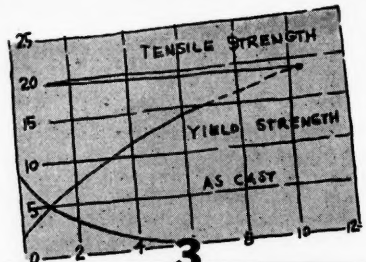
2d-11. Some Notes on the Production and Engineering Properties of Magnesium Alloys. F. A. Fox. *Machinery Lloyd* (Overseas Edition), v. 20, May 8, 1948, p. 68-77.

Production methods, properties of the various alloys; fabrication procedures; surface protection; and applications.

2d-12. Controverse sur le mécanisme de l'Electrolyse dans les cuves a aluminium. (Controversy Concerning the Mechanism of the Electrolysis Involved in Production of Aluminum.) *Journal du Four Electrique et des Industries Electrochimiques,* v. 57, Jan.-Feb. 1948, p. 8-12.

Resumé of extensive discussion and written communications presented at several meetings of Sociéte Francaise des Electricians during 1947.

For additional annotations indexed in other sections, see: 1c-46-47; 3b-83.



3 PROPERTIES

3a—General

3a-48. Electron Emission From Metal Surfaces. L. A. DuBridge. *American Journal of Physics,* v. 16, April 1948, p. 191-198.

Development of theory. (An address.) 10 ref.

3a-49. Statistical Analysis of the Relationship Between the Properties of Materials and the Useful Life of the Products. (In Russian.) N. P. Shchapov. *Collection of Reports Concerning the Dynamic Strength of Machine Parts,* Academy of Sciences of the U.S.S.R. 1946, p. 185-194.

Details of a statistical method developed.

3a-50. The Stopping Power of a Metal for Alpha-Particles. H. A. Kramers. *Physica,* v. 13, Aug. 1947, p. 401-412.

A theoretical, mathematical development.

3a-51. Inelastic Scattering of Fast Neutrons by Fe, Pb, and Bi. L. Szilard and Others. *Physical Review,* v. 73, June 1948, p. 1307-1310.

Experiments at the metallurgical laboratory of the University of Chicago under the auspices of the Manhattan District.

3a-52. Selecting Engineering Materials for Coke Plants. C. F. Pogacar. *Steel,* v. 122, June 7, 1948, p. 111, 114, 116, 118, 120, 123, 126.

Previously abstracted from *Blast Furnace and Steel Plant,* v. 36, April 1948, p. 439-442; May 1948, p. 555-559. See item 3a-42, 1948.

3a-53. These New Metals Challenge Old Stand-bys. *Modern Industry,* v. 15, June 1948, p. 50-53.

Several advantages of titanium, zirconium, and molybdenum as substitute metals for chromium, tungsten, and even aluminum and steel.

3a-54. Low-Temperature Test Witnessed by Engineers. *Welding Journal,* v. 27, June 1948, p. 456-457.

Results of a test of various metal experimental vessels at liquid nitrogen temperatures of below —300° F. The metals tested were 8½%-Ni steel, A.I.S.I. 2800; stainless steel, Type 304; and carbon steel, A.S.T.M. A-201. There was no material damage to the 8½%-Ni and stainless-steel vessels, while a carbon-steel vessel was shattered upon the first impact.

3b—Ferrous

3b-74. Creep of Steel and Concrete in Relation to Prestressed Concrete. Gustave Magnel. *Journal of the American Concrete Institute,* v. 19 *(Proceedings,* v. 44), Feb. 1948, p. 485-500.

Methods and results of creep tests performed on three different samples of steel wire under constant load and constant length conditions. Preparation of concrete specimens prestressed by use of these same wires.

(Turn to page 8)

HEAT TREAT FUNDAMENTALS

so as to obtain the mechanical structure best suited for a particular operation.

Fundamentally stated, a combination of grain size with the amount, size and spacing of the carbides in the matrix controls the physical properties. Alloying elements act in either of two ways—to increase the amount of carbides in the steel, or to affect the ductility of the matrix by going into solution in the ferrite.

Roughly, the fundamentals for the formation of this mental picture of mechanical structures are:

1. Steel is mainly iron.
2. Carbon gives the steel the quality of hardness, thus strength.
3. Steel is composed of grains which can be refined by heat treatment to a small grain size just above the critical range, or made to grow larger as temperature and time above the critical are increased.
4. Within the grains there is a mechanical mixture of carbides and ferrite, the relative amount of each being dependent upon the carbide content of the steel.
5. The kind of formation, size and spacing of these carbides in the matrix within the grains depend upon the rate of cooling from above the critical range of the particular steel. In unhardened steels, areas of lamellar pearlite are quite rigid and resist deformation and cutting action of a tool, while areas of the ferritic matrix are relatively soft, ductile and gummy. With the carbides in the spheroidized form, the structure within the grains is in the most ductile condition. The tempering of a fully hardened martensitic structure produces the best combination of obtainable physical properties. The product formed consists of a very fine, uniform dispersion of carbide spheroids which tend to coagulate as the temperature is increased, thus decreasing the hardness of the steel and increasing the ductility.

The more common heat treating operations for conditioning the grain size and carbides are:

1 Normalizing — the heating of steel approximately 125 to 200° F. above the critical range and cooling in still air. Normalizing tends to produce relatively large, coarse grains, with a relatively close spacement of the carbide particles in the lamellar pearlitic structure. With the exception of toolsteels, normalizing is generally done after forging, to provide a uniform grain size which in turn produces uniform results in subsequent heat treating and machining. All steels which have not been subjected to further heat treatment after hot rolling may be considered to be in a more or less uncontrolled normalized condition.

2. Annealing — the heating of steel approximately 50 to 75° above its critical range and cooling slowly to produce a soft structure. Annealing tends to produce a relatively fine grain, and generally a mixed lamellar and spheroidized carbide, with a rather coarse spacement of the carbides.

3. Spheroidized annealing—a special anneal to put the carbides in the spheroidal form within an extremely soft and ductile matrix. It is generally used on highly alloyed and tool steels. A fully spheroidized anneal, while good for high speed turning, acts gummy and is sometimes called too hard at the slower speed used in shaping and similar operations.

4. Stress annealing or stress relieving (sometimes called subcritical anneal)—the heating of unhardened steel below its critical temperature. This process is sometimes used after a normalizing treatment and is also used to relieve the stresses set up in the steel by cold work or machining strains. It may be used to equalize the stresses set up in the cooling of castings, although the incorrect term of normalizing is frequently given to this process.

5. Hardening—the heating of steel above its critical range and then quenching at a sufficiently rapid rate to produce a hardened structure. The steel is then in a very highly stressed and brittle condition and should be tempered immediately.

6. Tempering — the reheating of hardened steel at temperatures below its critical range in order to reduce the hardness, increase the ductility and lessen the internal strains. Practical results, especially at the lower temperatures used for tempering tool steels, have shown that for equal Rockwell hardness a longer draw at a somewhat lower temperature produces a tougher steel than does a short draw at higher temperature.

In the above, we have considered the mechanical structure of only those steels in common use. Steels that can be hardened and annealed are called pearlitic steels because of their tendency to produce the pearlitic structure on normal air cooling.

High content of certain alloys produces grades of steel that do not respond in the same way to these heat treating cycles. The following three types of stainless steel are in this class:

1. The "ferritic" grade, with low carbon content and with chromium (4 to 27%) as the chief alloying element. This grade does not harden to any appreciable extent, and when annealed the microstructure is primarily ferrite.

2. The "martensitic" grade, with carbon up to 1.10% and chromium 11.5 to 18%. These steels respond to heat treatment much the same as do the pearlitic steels.

3. The "austenitic" grade, containing 6 to 22% nickel and 16 to 26% chromium. This grade cannot be hardened by heat treatment, but is hardenable by cold working and is nonmagnetic unless severely cold worked. The combination of alloys used in this grade of stainless steel has produced a material so stable in the austenitic state that it may be heated and quenched without any hardening effect taking place.

Two facts are of interest in connection with these highly alloyed stainless steels: First, the fundamental pattern of the mechanical microstructure remains the same as for the pearlitic steels. Second, by the use of certain combinations of alloys, steels can be produced directly with inherent structural characteristics similar to those produced by heat treating the pearlitic steels.

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- Hotel reservation form on page 61.
- "Tribute to Alloy Steels" on inside back cover.
- Metallographic Exhibit entry rules on page 2.

3b-75. Melting Practice Vs. Properties of Medium-Carbon Low Alloy Cast Steel. *Industrial Heating,* v. 15, May 1948, p. 808, 810.

Condensed from "Some Effects of Melting Practice on Properties of Medium-Carbon Low-Alloy Cast Steel", by J. G. Kura and N. H. Keyser, *A.F.A. Preprint* No. 47-4, 1947.

3b-76. High Frequency Permeability. J. Smidt. *Applied Scientific Research,* v. B1, no. 2, 1948, p. 127-134.

Determines the permeability of iron by observing decrease in wave length measured on a coaxial cable, having an iron wire as inner conductor, compared with the wave length measured on a similar nonferromagnetic system, using the same frequency.

3b-77. The Sorption of Gases on a Plane Surface of Two Stainless Iron-Chromium-Nickel Alloys at 20, −78 and −183°. Marion H. Armbruster. *Journal of the American Chemical Society,* v. 70, May 1948, p. 1734-1742.

Sorption of A, Ne, H_2, N_2, CO, O_2 and CO_2 was measured at pressures up to 0.1 cm. on specially prepared surfaces.

3b-78. Carbon Steels; Abnormal Creep Resulting From Aluminum Additions. J. Glen. *Iron and Steel,* v. 21, May 13, 1948, p. 218-221; discussion p. 269-272.

Five-day creep tests were conducted on low-carbon steels containing 0.4 to 1.5% Mn, 0.01 to 0.15% Si, and up to 0.11% Mo, and with varying amounts of Al up to 3 lb. per ton. Mn, Si, and Mo reduce the creep rate and help to counteract the abnormal creep resulting from Al additions.

3b-79. Creep; Properties of Some Molybdenum-Bearing Steels. J. Glen. *Iron and Steel,* v. 21, May 13, 1948, p. 222-236, discussion p. 269-272.

Previously abstracted from *Journal of the Iron and Steel Institute,* v. 158, Jan. 1948, p. 37-80. See item 3b-28, 1948.

3b-80. Ingot Molds; A Comparison of Two Different Compositions. W. L. Kerlie. *Iron and Steel,* v. 21, May 13, 1948, p. 249-250; discussion p. 275-276.

Previously abstracted from *Journal of the Iron and Steel Institute,* v. 157, Nov. 1947, p. 410-415. See item 3b-2, 1948.

3b-81. Wear Tests on Grinding Balls. T. E. Norman and C. M. Loeb. *Mining Technology,* v. 12, May 1948, T.P. 2319, 31 pages.

Previously abstracted from *Metals Technology,* v. 15, April 1948. See item 3b-58, 1948.

3b-82. Influence of Low Temperatures on the Mechanical Properties of 18-8 Chromium-Nickel Steel. D. J. McAdam, G. W. Geil, and Frances Jane Cromwell. *Journal of Research of the National Bureau of Standards,* v. 40, May 1948, p. 375-392.

By means of tension tests of notched and unnotched specimens, an investigation was made between room temperature and −188° C. One of the steels was ferritic; the others were of the metastable austenitic type. Plastic deformation of the latter alloy causes a phase change and thus hardens the alloy. 19 ref.

3b-83. Black-Heart Malleable Iron; Solved and Unsolved Metallurgical Problems. H. A. Schwartz. *American Foundryman,* v. 13, June 1948, p. 46-54.

Tenth Edward Williams Lecture at annual conference of Institute of British Foundrymen, London, June 8-11, 1948. Comprehensive resume and bibliography of fundamental information. 121 ref.

3b-84. The Influence of Manufacturing Factors on The Magnetic Properties of Transformer Sheets. (Concluded.) G. Delbart, R. Potaszkin, and M. Sage. *Sheet Metal Industries,* v. 25, June 1948, p. 1127-1134, 1142.

Results obtained during continued investigation: sheet rolling conditions and results of analysis and micrographic examinations; classification of structures of plates and sheets into types corresponding to uniform recrystallization structures, cold worked recrystallization structures, and fibrous texture; examples of appearance of structure of rolled sheets and annealed sheets; and results of magnetic tests.

3b-85. The Physics of Sheet Steel. G. C. Richer. *Sheet Metal Industries,* v. 25, June 1948, p. 1135-1140.

A working generalization and the Barkhausen effect, qualitative and quantitative determinative variables.

3c—Nonferrous

3c-27. Recherches Electrochimiques sur le Tantale. (Electrochemical Research Concerning Tantalum.) M. Haissinsky, A. Coche and M. Cottin. *Journal de Chimie Physique et de Physico-Chimie Biologique,* v. 44, Oct. 1947, p. 234-241.

Results of a study of electrochemical potentials of tantalum in various acidic and basic media. Variation of potential as a function of pH is charted. Also gives potentials obtained for combinations of Ta. 12 ref.

3c-28. Resistance of Copper Alloys to Hydraulic Pressure. (In Russian.) A. M. Korol'kov. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R. Section of Technical Sciences), Jan. 1948, p. 97-101.

Resistance to load decrease on addition of Si or Pb. This decrease is connected with the crystallization of the alloys over a large temperature interval. The most resistant were the aluminum bronzes which crystallize within a small interval. Decrease of resistance is also connected with the phenomenon of disseminated porosity during solidification.

3c-29. Ueber die Dauerstandfestigkeit von Zinklegierungen. (Creep Resistance of Zinc Alloys.) O. H. C. Messner. *Schweizer Archiv fur angewandte Wissenschaft und Technik,* v. 14, March 1948, p. 86-94; April 1948, p. 118-127.

Creep resistance of zinc is very low, but may be increased by proper treatment. Creep strength varies with composition but is much more influenced by methods of fabrication, such as heat treatment and working. No definite relationship between creep strength and grain size or structure was found; nor between short and long-term test results. The most likely cause of creep seemed to be internal slip in the crystals.

3c-30. The Effect of Small Percentages of Silver and Copper on the Creep Characteristics of Extruded Lead. G. R. Gohn and W. C. Ellis. *American Society for Testing Materials, Preprint* No. 25, 1948, 14 pages.

Creep tests on longitudal tension-test specimens taken from a series of Pb-Ag alloys extruded in the form of 0.140-in. pipe and containing various percentages of Cu indicate that Ag up to 0.010% improves creep resistance at stresses of 400 psi. and above.

3c-31. Influence of Small Percentages of Silver on the Tensile Strength of Extruded Lead Sheathing. Howard S. Phelps, Frank Kahn, and William P. Magee. *American Society for Testing Materials, Preprint* No. 26, 1948, 10 pages.

Stress-rupture tests were made on a series of extruded-cable sheathing pipe samples of substantially pure lead to which various percentages up to 0.018% of silver were added. Extrapolation of results indicates probability of improved stress-rupture and creep characteristics at operating stresses when silver up to approximately 0.010% is added. Undesirable results are indicated for addition of silver alone in excess of 0.010%.

3c-32. Effects of Nickel, Zinc and Lead Additions to 5% Tin Bronze. Ralph L. Fox, Jr. *Foundry,* v. 26, June 1948, p. 102-103, 258, 260, 262.

Experimental results.

3c-33. Untersuchungen an Antimon-Einkristallen im transversalen Magnetfeld. (Investigation of an Antimony Crystal in a Transverse Magnetic Field.) Konrad Rausch. *Annalen der Physik,* ser. 6, v. 1, May 22, 1947, p. 190-206.

The relative electrical and thermal resistance of an antimony crystal in transverse magnetic fields up to 12 kilogauss. The differential thermo-electric force for antimony vs. constantan and for antimony perpendicular vs. antimony parallel to a crystal plane for temperatures of −194 to 25° C.; and the effect of a magnetic field on these values. 30 ref.

3c-34. Druck- und Temperaturkoeffizient des elektrischen Widerstandes einiger Legierungen. I. Einleitende Versuche. (Pressure and Temperature Coefficients of Electrical Resistance of Several Alloys. I. Introductory Research.) H. Ebert and J. Gielessen. *Annalen der Physik,* ser. 6, v. 1, May 22, 1947, p. 229-240.

Several two and three-element nonferrous alloys were investigated for their pressure and temperature coefficients. A number of them showed promise as materials for precision resistances.

3c-35. Improving Properties With Nickel Alloys. J. S. Vanick. *Canadian Metals & Metallurgical Industries,* v. 11, May 1948, p. 14-18.

What nickel does for bronze. An extensive survey of the improvements made in bronze alloys, together with the finished products' application. (To be continued.)

3c-36. Composition and Properties of Zinc Alloy Die Castings. *Production Engineering & Management,* v. 21, June 1948, p. 73.

Data for Zamak-3 and Zamak-5.

3d—Light Metals

3d-25. Investigations on Aluminum Alloys of High Strength at Room Temperature. Part II. B. W. Mott. *Metal Treatment.* v. 15, Spring 1948, p. 33-46.

Investigation made into the properties of wrought aluminum alloys containing Mg, Zn, and Mn as the principal alloying elements. The tests involved the determination of tensile properties, hardness, and forging behavior; and some tests were also made on the suitability of the alloys for casting. (To be concluded.)

3d-26. Stress-Strain and Elongation Graphs for Alclad Aluminum-Alloy 24 S-T Sheet. James A. Miller. *National Advisory Committee for Aeronautics, Technical Note* No. 1512, May 1948, 37 pages.

Tensile and compressive stress-strain and stress-deviation to a 1%

(Turn to page 10)

Heat Treating Today

By Arthur R. Elsea
Metallurgical Engineer, Battelle Memorial Institute

Assimilation and Discussion of War Developments Is Found in the Literature of the Past Six Months

HEAT TREATMENT makes it possible to alter the properties of metals and alloys so that these materials can be more readily adapted to the requirements of modern engineering design. Many castings, forgings and stampings, which would otherwise be unmachinable or dimensionally unstable, are readily machined to close tolerances after the proper heat treatment. In many alloys, the optimum combination of strength and ductility is brought about by controlled heat treatment. Surfaces subjected to wear can be made hard and wear resistant by such heat treating processes as carburizing, nitriding, and flame or induction hardening. Magnetic and electrical properties of alloys may be greatly improved by proper heat treatment. These and many other changes induced by heat treatment are actually caused by changes in internal structure. Such structural changes are the result of recrystallization, diffusion, precipitation, agglomeration, and transformation phenomena that occur during heat treatment.

Research coupled with practical experience constantly advances the understanding of these basic phenomena, and as the understanding increases so does the ability to control heat treating processes.

During the recent war considerable research was conducted on the various phases of heat treating. As a result, many new concepts were established and presented in the metallurgical literature during the years immediately following the war. The past six months has been a period of assimilation and discussion rather than one of development. The literature in this period has consisted of trade notes, summaries and reviews of earlier research, and a few technical papers describing new research.

From the trade notes, it is apparent that the trend in industry is toward the use of controlled atmosphere and neutral salt bath heating to eliminate scaling and decarburization. Also reported are numerous automatic heat treating installations which tend to eliminate the human element and thus to improve the uniformity of the heat treated product. (Some of the newly developed equipment furthering these ends is described in the article beginning on page 13.)

Austenite Transformation

Most heat treating operations conducted on steels are concerned with the transformation of austenite to aggregates of ferrite and cementite or to martensite. Before Davenport and Bain published their work on the "Transformation of Austenite at Constant Subcritical Temperatures," very little was known about the mechanism of austenite decomposition. This pioneering paper, together with the work by Greninger and Troiano and similar isothermal transformation studies has greatly clarified our understanding of these basic heat treating phenomena. Boyer (18b-33 and 18b-34, April 1948)* gives a general review of the present concept of austenite decomposition, placing special emphasis upon the interpretation of TTT-curves and upon the variables which affect the formation of martensite.

Investigations of the austenite-to-martensite reaction have been hampered by the lack of a convenient and accurate quantitative determination for retained austenite. Metallographic methods are unsatisfactory, especially in fine-grained steels, since the measurements are not too accurate for small amounts of residual austenite, and the tempering operation necessary to delineate the austenite may result in further transformation. Dilatometric and magnetic methods may be used to determine changes in the amount of austenite present, but they are useless for absolute measurements.

Averbach and Cohen (11-31, March 1948) have developed a method whereby integrated intensities of the lines in an X-ray diffraction pattern are used to determine the amount of retained austenite present in hardened steels. No external calibration or standard reference foil is necessary and the method can be applied to steel in the hardened condition without the use of a tempering treatment. Employing the new technique Averbach and Cohen show that normally hardened 1% carbon (plain or chromium-bearing) toolsteels retain 7 to 10% austenite after quenching and remaining at room temperature for several days. They also show that a retarded rate of cooling through the martensite-forming temperature range increases the amount of retained austenite, but that retained austenite undergoes slow isothermal transformation upon aging at room temperature.

Interest in the transformation of austenite is not limited to the steel metallurgist. With the object of possibly improving the mechanical properties of cast iron through isothermal heat treatment, Nagler and Dowdell (4b-11, April 1948) investigated the isothermal transformation characteristics of five cast irons, covering a range of 0 to 0.5% molybdenum. Using both metallographic and magnetic methods, they studied the transformation rate at 100° intervals between 400 and 1300° F. The results of this investigation show that the TTT-curve for cast iron is not a simple S-curve, as previously believed. In the lower temperature range (400 to 700° F.) additions of molybdenum have little or no effect upon the transormation rate. However, above 700° F., molybdenum additions progressively increase the hardenability (reduce the transformation rate.

Apparently, the effect of molybdenum upon the transformation of austenite is about the same whether the austenite is present in steel or in cast iron, since in either case it tends to retard transformation much more in the pearlite range than in the bainite temperature range. No conclusions were drawn regarding the possibilities of isothermally heat treating molybdenum cast irons. However, from the shape of the curves and the indicated hardenability, such heat treating methods should be feasible.

Malleabilization

Malleable cast iron has been recognized as an important engineering material ever since its development early in the eighteenth century, and there are still many applications in modern engineering design for which it is far superior to any other material. The process for making malleable cast iron has seen little change in the past 200 years. It consists of first producing brittle white iron

(*Turn to page* 11)

*Literature references are cited by the corresponding item number in the *Review of Current Metal Literature* instead of repeating entire title, author, and source; this information can be obtained by referring to *Metals Review* for the month indicated.

strain; tangent modulus and reduced modulus for a rectangular section against stress in compression; stress-strain of tensile specimens tested to failure; and local elongation and elongation against gage length for tensile specimens tested to fracture.

3d-27. Stress-Strain and Elongation Graphs for Alclad Aluminum-Alloy 24 S-T 81 Sheet. James A. Miller. *National Advisory Committee for Aeronautics, Technical Note,* No. 1513, May 1948, 36 pages.

Data similar to that of Technical Note No. 1512 (see above abstract), for 24 S-T 81.

3d-28. Hardness Ranges for Various Materials. *Materials & Methods,* v. 27, May 1948, p. 105, 107.

Data for 78 materials.

3d-29. Variation du Pouvoir Thermoelectrique des Metaux par Dissolution d'Elements. (Variation of the Thermoelectric Properties of Metals on Addition of Other Elements.) Charles Crussard and Francis Aubertin. *Comptes Rendus* (France), v. 226, March 22, 1948, p. 1003-1005.

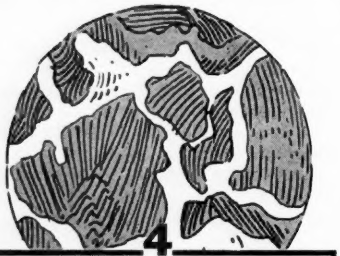
Results of determination of variations caused by addition of Sn, Si, Ti, Cr, Mn, Fe, Ni, Cu, and Mg to 99.995% Al. Results are correlated with position in the periodic table.

3d-30. Engineering Characteristics of 61 S Aluminum Alloy Sheet. Joseph J. Warga. *Product Engineering,* v. 19, June 1948, p. 108-112.

Fabricating and engineering properties of sheet Al-Mg-Si alloys 61 S. Data on heat treatment; mechanical properties of sheet, both without and with heat treatment, and in workhardened conditions; and resistance to corrosion. Welding and forming characteristics.

For additional annotations indexed in other sections, see:

9a-39-40; 23b-32; 23c-39; 27a-83-86-89; 27b-32-33.



CONSTITUTION and STRUCTURE

4a—General

4a-21. On the Calculation of the Energy of a Bloch Wave in a Metal. J. Korringa. *Physica,* v. 13, Aug. 1947, p. 392-400.

General formulas for this calculation were obtained by application of the dynamical theory of lattice interferences to electron waves.

4a-22. On the Order-Disorder Transition in Solids. Part I and II. Yosio Muto. *Journal of Chemical Physics,* v. 16, May 1948, p. 519-525.

Theoretical, mathematical developments.

4a-23. Convenient Methods for Obtaining d/n Values From X-Ray Diffraction Patterns. C. B. Stewart and E. S. Lutton. *Journal of Applied Physics,* v. 19, May 1948, p. 507.

Theoretical consideration of instantaneous rate of grain growth in high purity Al and other materials.

4a-24. Influence of Molecular Interaction on Phase Equilibriums in Binary Systems. (In Russian.) V. I. Danilov and D. S. Kamenetskaya. *Zhurnal Fizicheskoi Khimii* (Journal of Physical Chemistry), v. 22, Jan. 1948, p. 69-79.

A theoretical, mathematical development which indicates that the type of constitutional diagram of binary systems is determined by the bonding energy between similar and dissimilar molecules in the two phases present. Application to both metallic and organic-compound systems.

4a-25. Dependence of the Type of Constitutional Diagrams of Binary Alloys on Their Molecular Interaction. (In Russian.) D. S. Kamenetskaya. *Zhurnal Fizicheskoi Khimii* (Journal of Physical Chemistry), v. 22, Jan. 1948, p. 81-89.

A geometrical method of thermodynamic potential analysis, calculated according to the method of Becker-Pines. Using the method of Rosenbum, different types of constitutional diagrams were investigated in the light of molecular interaction.

4a-26. A Note on Gaseous Thermal Diffusion: the Effect of a Third Component. John Chipman and Minu N. Dastur. *Journal of Chemical Physics,* v. 16, June 1948, p. 636-637.

In the reaction of hydrogen with oxygen dissolved in molten iron, a controlled mixture of hydrogen and water-vapor impinges upon the surface of the molten metal which is heated and also stirred by high-frequency induction. Thermal diffusion takes place near the hot metal surface, the result being a lower oxygen content of the metal than that corresponding to equilibrium. Admixture of argon minimized thermal separation in accordance with theory.

4b—Ferrous

4b-35. Unusual Structures Observed in Gray Cast Irons of High Sulphur Content. J. E. Rehder. *American Foundryman,* v. 13, May 1948, p. 91-93.

In a commercial gray-iron foundry, cast iron of high sulphur content was produced by accident on two occasions. Subsequent examinations revealed unusual microstructures and reactions to heat treatment.

4b-36. Influence of Boron on the Structure of High-Speed Steel. (In Russian.) A. K. Shevelev. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 18, Jan. 1948, p. 99-104.

Addition of boron contributes to the retaining of residual austenite in tempered steel, the amount of which increases with boron content. Furthermore, the addition of boron contributes to the regrouping of carbides.

4b-37. Nodular Graphite; Production in Cast Iron. H. Morrogh and W. J. Williams. *Iron and Steel,* v. 21, May 13, 1948, p. 208-214; discussion p. 266-268.

Previously abstracted from *Journal of the Iron and Steel Institute,* v. 158, Mar. 1948, p. 306-322. See item 4b-27, 1948.

4b-38. Carbides; Occurrence in Iron-Carbon-Silicon Alloys and Cast Irons. D. Marles. *Iron and Steel,* v. 21, May 13, 1948, p. 215-217; discussion p. 266-268.

Previously abstracted from *Journal of the Iron and Steel Institute,* v. 158, Apr. 1948, p. 433-436. See item 4b-33, 1948.

4b-39. Nonmetallic Inclusions; A Micro-Examination of Eight Steels. J. H. Whiteley. *Iron and Steel,* v. 21, May 13, 1948, p. 237-241; discussion, p. 272-275.

Previously abstracted from *Journal of the Iron and Steel Institute,* v. 157, Sept. 1947, p. 89-97. See item 4-172, R.M.L., v. 4, 1947.

4b-40. Mild Steel Weld Metal; Some Thermodynamical Aspects of the Formation of Inclusions. E. C. Rollason and E. Bishop. *Iron and Steel,* v. 21, May 13, 1948, p. 246-248; discussion, p. 272-275.

Previously abstracted from *Journal of the Iron and Steel Institute,* v. 158, Feb. 1948, p. 161-168. See item 4b-19, 1948.

4b-41. Contributo allo Studio della Morfologia delle Inclusioni non Metalliche nei Prodotti Siderurgic. Inclusioni nel Ferro Puro Industriale. (Contribution to the Study of the Morphology of Nonmetallic Inclusions in Ferrous Materials. Inclusions in Commercial Iron.) Raffaello Zoja. *La Metallurgia Italiana,* v. 39, Nov.-Dec. 1947, p. 267-280.

Results of investigation of 99.9% Fe produced on a semicommercial scale with regard to the frequency, distribution, and grouping of the different types of nonmetallic inclusions. Electrolytic, Armco, and "Ferrital" irons were also investigated.

4b-42. L 'Ossigeno nell' Acciaio. (Oxygen in Steel.) Adolfo Antonioli. *La Metallurgia Italiana,* v. 39, Nov.-Dec. 1947, p. 289-293.

An article by Castagneri, and also the work of several other investigators regarding the oxygen equilibria in steel and methods for its determination, are critically analyzed.

4b-43. Graphitization of Low-Carbon Low-Alloy Steel—an Appraisal of the Literature. G. V. Smith. *Welding Journal,* v. 27, June 1948, p. 277s-284s.

Various investigations reported since 1943. 30 ref.

4c—Nonferrous

4c-32. Mechanical Behavior of Crystal Boundaries in Metals. R. King, R. W. Cahn, and B. Chalmers. *Nature,* v. 161, May 1, 1948, p. 682.

Results of some preliminary experiments on specimens of tin subjected to tensile loading so arranged as to provide a component of shear stress acting on the boundary. When such a stress was applied at a temperature a few degrees below the melting point, progressive relative shear displacement of the two crystals took place.

4c-33. Ultrasonic Observation of Twinning in Tin. W. P. Mason, H. J. McSkimm, and W. Shockley. *Physical Review,* Series 2, v. 73, May 15, 1948, p. 1213-1214.

The method of experimentation consists of pressing the metal specimen directly against a quartz crystal with a liquid seal, applying stresses which deform the metal, and observing the resulting motion imparted to the quartz. Results are in general agreement with passage at the speed of sound of twinning dislocations from side to side in the specimen. However, the magnitude of the displacement is about 10 times larger than would be expected from the twinning of one pair of planes.

4c-34. On the Relation Between Deformation and Recrystallization Texture of Nickel-Iron With Cubic Orienta-

(*Turn to page 12*)

castings in which the carbon is all in the form of iron carbide, and subsequently decomposing this carbide to ferrite and graphite by a heat treating process yielding tough, ductile castings.

There are, in general, two processes for making malleable iron—the Whiteheart process used extensively in European countries and the Blackheart process used in this country. In the Whiteheart process carbon is intentionally removed from castings during the anneal or malleabilization by conducting this operation in an oxidizing or decarburizing atmosphere, while in the Blackheart process, the object is merely to decompose the brittle carbides, retaining all of the carbon in the form of temper carbon or graphite nodules.

In the Whiteheart process, castings are traditionally packed in containers of iron ore to produce the desired oxidizing atmosphere and to give support so as to eliminate distortion during the anneal. Heating of this large mass of ore is costly and time consuming. The labor cost for packing, unpacking, and sorting the finished castings alone is no small item. Therefore, the general interest in the modern gaseous annealing process is understandable.

Jenkins (18-240, Dec. 1947) describes how this new process makes use of controlled atmospheres in the annealing furnaces to maintain the desired rate of decarburization. Almost any desired heating or cooling rate may be maintained since heat is transferred to and from the castings directly from the furnace atmosphere and by radiation, rather than through a packing medium such as ore. Annealing cycles can be devised to give the optimum mechanical properties for a given application. Hancock (18b-46, May 1948) gives examples of a number of new installations for gaseous annealing of Whiteheart malleable.

Over a period of years a number of investigations have been conducted to determine the effects of alloys and residual elements on the annealability of white cast iron. Palmer (3-366, Dec. 1947) shows the effect of varying the manganese-sulphur ratio on the annealing characteristics of Whiteheart malleable iron, and the effects of 17 different alloy additions on the annealing rate of Blackheart malleable iron. In general, when insufficient manganese is present in Whiteheart malleable to tie up all the sulphur in the form of manganese sulphide, the graphite nodules which form during the anneal are quite compact, and the matrix tends to become more ferritic. With an excess of manganese over that required to tie up the sulphur, the graphite nodules become open and lacy and the matrix tends to become more pearlitic. Of the 17 alloy additions made to Blackheart, boron, sulphur, vanadium, chromium, aluminum, antimony, and bismuth all drastically reduced the rate of first-stage anneal (eutectic carbide decomposition), while nickel and copper had, if anything, a slightly beneficial effect.

The Problem of Peel

Manufacturers of Whiteheart iron frequently encounter a defect known as peel. Castings exhibiting this defect are characterized by a weak surface layer which, under relatively light stresses, spalls off. The remainder of the casting is usually of too light a cross section to carry the load and failure occurs. During the war, peel became a serious problem in England through the failure of track links for military vehicles.

The defect was known to be associated with a high sulphide content at the core-peel interface, but the exact mechanism of formation of this sulphur-rich layer was not known. Four investigations of this problem were reported in a "Symposium on the Peeling of Whiteheart Cast Iron", under the sponsorship of the Iron and Steel Institute.

After studying specimens which were malleableized in mixtures of CO, CO_2 and SO_2, Preece and Irvine (18b-19, March 1948) concluded that the conditions which promote peel are: (a) the presence of sulphur in the atmosphere during the anneal, (b) a highly reducing atmosphere (a high $CO:CO_2$ ratio), (c) partial decarburization of the white iron.

Absorption of sulphur by the metal may take place directly from the atmosphere or from an oxide-sulphide scale formed on the surface of the casting during the anneal. The oxide-sulphide scale can form in oxidizing atmospheres, but diffusion of sulphur into the metal does not occur until the atmosphere becomes strongly reducing late in the malleableizing process. Thus, peel should not be encountered in the new gaseous annealing process, since the atmosphere can be maintained strongly oxidizing throughout the anneal.

Bowden (18b-20, March 1948) studied the structures of a number of peeled track links and correlated the structures with the conditions under which the links were made. He concluded that peeling occurs when the malleableizing atmospheres contain abnormally high proportions of carbon monoxide. In order to avoid peel, the atmosphere should be maintained strongly oxidizing by the use of ores high in Fe_2O_3, and the white iron castings should be low in sulphur, high in manganese (0.4% maximum), and as low in silicon as is consistent with ready response to malleabilization.

Webster and Probst (18b-21, March 1948) attacked the problem of peeling by conducting a number of malleableizing tests on step bar castings of varying sulphur content, using various mixtures of new ore (high in Fe_2O_3), spent ore (low in Fe_2O_3), and sometimes iron pyrites (FeS_2) as packing material. They concluded that the sulphur content of the packing material has a very strong tendency to promote peel formation, but that the sulphur content of the metal does not seem to influence the formation of peel. They also found that the higher the Fe_2O_3 content of the packing material, the greater the tendency for peel formation.

Bernstein (18b-22, March 1948) conducted malleableizing tests on white iron bars with varying sulphur, manganese, silicon, and carbon contents. In some of the tests packing ores of various sulphur and Fe_2O_3 content were used, and in other tests prepared mixtures of carbon dioxide, carbon monoxide, nitrogen, water vapor, and sulphur dioxide. His tests indicate that peel formation is promoted by the following:

1. High sulphur content of the ore or sulphur dioxide content of the annealing atmosphere.
2. Low manganese-sulphur ratio in the metal.
3. Stronger decarburizing tendencies of the annealing atmosphere.
4. High annealing temperatures.
5. Long annealing times.
6. High silicon in the metal.
7. Low carbon in the metal.

The results of these four research investigations on peeling in Whiteheart malleable cast iron show that a lot remains to be learned about this defect and its causes. However, there seems to be general agreement that sulphur in the packing ore or sulphur dioxide in the annealing atmosphere promotes the formation of peel.

A Good Book

In "Ferrous Metallurgical Design" by John H. Hollomon and Leonard D. Jaffee (27-119, Aug. 1947) the authors have brought together, under one cover, many of the present theoretical concepts of austenite transformation, mechanical behavior of metals, and heat flow in metals. They have attempted to derive from these concepts a method whereby the most logical choice of steel and heat treatment can be calculated so as to obtain the optimum properties for the particular application in question, without going through the usual cut-and-try method or applying the not-too-reliable rules of thumb. Their process consists of determining the hardenability required to fully harden the heaviest section in the part, and then selecting a steel with this hardenability, bearing in mind such factors as temperability, temper brittleness and corrosion resistance.

This process seems logical and many of the tables and charts included in the book should be helpful in making these estimations. However, some caution should be exercised in attempting to calculate hardenability, since these calculations result in poor approximations at best.

tion. J. F. H. Custers. *Physica,* v. 13, March 1947, p. 97-116.

Comparison of structures of Ni-Fe and aluminum after cold rolling in a (100) direction and parallel to a (100) plane. Deformation structures were similar, but there was a marked difference in recrystallization structure, which is explained.

4c-35. Sur les Transformations du Cerium a Haute Temperature. (Concerning the Transformation of Cerium at High Temperatures.) Jean Loriers. *Comptes Rendus* (France), v. 226, March 22, 1948, p. 1018-1019.

There are two or three transformations of pure cerium between 600° C. and its melting point. Effect of Fe, Si, Ca, and Al on behavior of Ce at high temperatures.

4c-36. Etude des Transformations Allotropiques du Cérium Pur et d'un Cérium Industriel. (Study of Allotropic Transformations in Pure and Commercial Cerium.) Felix Trombe and Marc Foex. *Revue de Métallurgie,* v. 44, Nov.-Dec. 1947, p. 349-356.

Results of a comparative study. The commercial metal contained 0.22% Fe, 0.08% Al, 0.15% Ca, and traces of Mg and C. The presence of alpha, beta, gamma, and delta phases at 400 to 500° C. Causes of anomalous transformations at low temperatures.

4d—Light Metals

4d-11. Investigation of the Influence of Grain Size on the Relationship Between Compression Rates and Stresses During Plastic Deformation. (In Russian.) L. D. Sokolov. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 18, Jan. 1948, p. 89-92.

Cylindrical specimens of aluminum of different grain size were compressed at rates between 0.01 and 1 mm. per sec. It was found that the "rate coefficient" has a lower value for specimens with a smaller grain size. The dependence of rate coefficient behavior on the increase of deformation in the case of high and low-melting metals and alloys. 12 ref.

4d-12. Kristalvorm en groeisnelheid bij Rekristallisatie van Aluminium. (Crystal Formation and Speed of Growth by Recrystallization of Aluminum.) W. G. Burgers and W. May. *Metalen,* v. 2, April 1948, p. 172-179.

Results of an investigation on stretched Al single crystals and polycrystalline material. Twinning and "stimulation" of crystals.

4d-13. Crystal Orientation in Al by Slow Neutron Diffraction. G. Arnold and A. H. Weber. *Physical Review,* v. 73, June 1948, p. 1385-1389.

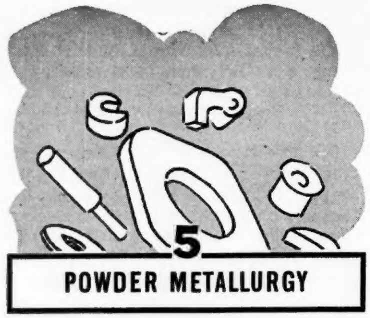
Investigations of crystal orientation effects in various forms of aluminum by measurement of total cross sections in the approximate neutron-energy range 0.003 to 0.05 ev.

4d-14. Etude aux Rayons X de la Structure des Alliages Aluminium-Plomb et Aluminium-Plomb-Magnésium. (X-Ray Investigation of the Structure of Aluminum-Lead and Aluminum-Lead-Magnesium Alloys.) Mladen Paic. *Revue de Métallurgie,* v. 44, Nov.-Dec. 1947, p. 363-373.

Different aspects of segregation of Pb in the above alloys of high Al content. Effects of Pb content, temperature, and method of casting on alloy structure. It is believed that the method of addition of Pb is of importance. 14 ref.

For additional annotations indexed in other sections, see:

3b-83; 18d-5; 19a-109-110; 27a-86-91; 27b-32-33.



5a—General

5a-30. Le Moulage et le Frittage des Poudres Métalliques. (Molding and Sintering of Metal Powders.) Georges Blanc. *Fonderie,* Jan. 1948, p. 1007-1021.

Recent developments. 27 ref.

5a-31. Préparation des poudres métalliques par Electrolyse Ignée. (Preparation of Metallic Powders by Electrolysis.) *Journal du Four Electrique et des Industries Electrochimiques,* v. 57, Jan.-Feb. 1948, p. 12-14.

Technique developed, including method for separation of the crystals from the bath. Choice of the bath solution, and of material for the anode, cathode, and diaphragm.

5a-32. Metal Ceramics; A New Field in Powder Metallurgy. H. H. Hausner. *Metal Industry,* v. 72, May 14, 1948, p. 405-407.

Based on paper presented at annual Spring meeting of the Metal Powder Assoc.

5a-33. Protective Atmospheres; Comparison of Methods Available for the Sintering Process. N. K. Koebel. *Metal Industry,* v. 72, May 21, 1948, p. 426-427.

5a-34. Compressibility Factor; Development of a General Formula. G. B. Smith. *Metal Industry,* v. 72, May 21, 1948, p. 427.

An empirical formula for use in estimation of the compressibility of a metal powder or blend of powders is presented and checked by use on three different blends of Cu-base powders.

5b—Ferrous

5b-21. Powder Metallurgy; Notes on Steel and Alloy Steels. H. W. Greenwood. *Iron and Steel,* v. 21, May 1948, p. 183-184.

German practice and new information furnished by Iron & Steel Institute Special Report No. 38 on the recent Symposium on Powder Metallurgy.

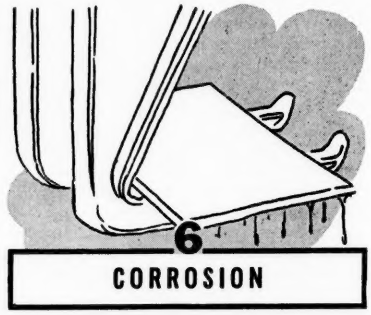
5b-22. Magnetic Properties of Iron Powder as Affected by Changes in the Surface Conditions of the Particles. Gustav F. Huttig and Helmut Rainer. *Powder Metallurgy Bulletin,* v. 3, May 1948, p. 48-60.

Results of an extensive experimental investigation, after surveying the literature on the subject. Effects of various factors and treatments including packing density, alcohol treatment, etching in air, etching followed by rusting, air oxidation at 200° C., eosin staining, and hydrogen reduction.

5c—Nonferrous

5c-20. Tungsten Carbide Dies; German Production For Wire, Bar and Tube Drawing. *Wire Industry,* v. 15, May 1948, p. 324, 326-327.

Based on B.I.O.S. Report No. 1711.



6a—General

6a-50. Electropotentials in Growing Halide and Oxide Layers on Metals. Andrew Dravnieks and Hugh J. McDonald. *Journal of the Electrochemical Society,* v. 93, May 1948, p. 177-190.

Electropotentials can be obtained experimentally by means of an electrode probe; the transference numbers can then be calculated. The method was tested on silver and lead bromide and chloride and on cuprous iodide and oxide scales, and values in agreement with those found by other methods were obtained. The oxides on Fe, stainless steel, Ni, Al, Zn, Mo, and W were investigated and found to be predominately electronic conductors; however, there is some doubt in the case of W. 32 ref. (Prepared for delivery at Columbus, Ohio, meeting, of the Society, April 14 to 17, 1948.

6a-51. Peculiarities of Reactions of Certain Organic Acids With Industrial Metals. (In Russian.) V. D. Yakhontov. *Zhurnal Obshchei Xhimii.* (Journal of General Chemistry), v. 17 (79), Nov 1947 p. 2054-2057.

Reactions of Mg, Zn, Al and its alloys, Pb, Cu, and a carbon steel with formic, acetic, oxalic, and maleic acids.

6a-52. Design of Exhaust Systems; Handling Corrosion Fumes and Gases. F. H. Stebbins. *Sheet Metal Worker,* v. 39, May 1948, p. 55-56, 105.

Qualitative resistance to corrosion by various acids of various metals, alloys, and other materials.

6a-53. Report of Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys. *American Society for Testing Materials, Preprint* No. 9, 1948, 25 pages.

Includes "Apparatus and Factors in Salt Fog Testing", by V. M. Darsey and W. R. Cavanagh; and "Report of Subcommittee VIII on Galvanic and Electrolytic Corrosion. Stainless Steels Coupled with Other Metals—Five Years Exposure".

6a-54. Alloying Steels for Corrosion Resistance to Gas-Condensate Fluids. Part I. C. K. Eilerts, Faye Green, F. G. Archer, Betty Hanna, and L. M. Burman. *Corrosion,* v. 4, June 1948, p.245-263.

Results of tests made by Bureau of Mines using aqueous solutions of carbonic acid, propionic acid, and phenol maintained at 130° F., in determining relative resistance to corrosion of carbon steels, Cr steels, Ni steels, Cr-Ni steels, Cu-Ni steels, and Cu-Ni alloys. 9%-Ni steel was

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Heat Treating Equipment and Supplies

New Products Introduced During the Past Six Months to Help Keep Your Heat Treating Department up to Date

IMPROVED furnaces, new models and recent installations take the lead in the field of new equipment for heat treating introduced during the past six months. Controlled atmosphere equipment, salt baths, induction heating machines, refractories and furnace materials, and temperature controllers are a few of the other categories in which new developments have been announced in this period.

The following article describes these developments, largely in the words of the manufacturers. The descriptions are necessarily brief, but more complete details are readily available from the manufacturers. Each of the descriptions is numbered and a coupon is provided on page 23. To secure further information on one or more products, it is only necessary to circle the corresponding numbers on the coupon and return it to *Metals Review.*

General Purpose Furnaces

Westinghouse Electric Corp. **(569)** early this year announced its entry into the field of gas-fired furnaces, supplementing its regular line of electric furnaces. Types are available for annealing, carburizing, drawing, hardening, tempering, malleableizing, and dry cyaniding, and for use with prepared atmospheres such as Exogas, Endogas, Monogas, or Ammogas.

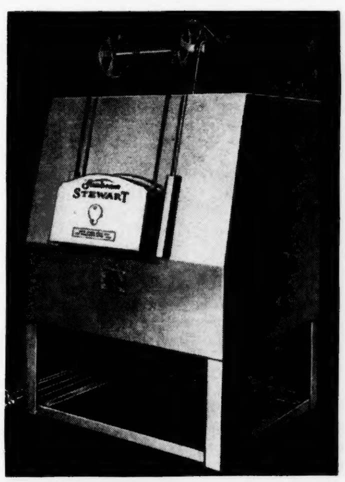
The line includes cylindrical bell types for bright annealing of copper or steel wire or strip in coils; continuous pusher types for annealing, gas carburizing, hardening, and malleableizing; continuous roller-hearth furnaces for cycle annealing, hardening, malleableizing and drawing; and continuous conveyer furnaces for light and medium weight parts.

The wide operating range—400 to 1850° F.—of the new Sunbeam Stewart electric heat treating and preheat unit **(570)** makes it useful for a number of purposes, as well as preheating high speed steel. Heating elements on four sides of the chamber give close temperature control and even heat distribution. The elements are formed from nickel-chromium alloy ribbon into continuous loops supported with insulators so as to allow free expansion and contraction and heat radiation. They

Cooley Model VK-6 Electric Furnace

can be replaced by removing the door vestibule tiles.

The new Model VK-6 Cooley electric box furnace introduced by Cooley Electric Mfg. Corp. **(571)** has a range of 300 to 2000° F., making it adaptable for both hardening and other high-temperature operations and for low-temperature applications such as tempering and nonferrous heat treatment. The VK-6 is similar to the earlier Model VK-5, but has a simplified vertical lift door with exterior mechanism and counterweights. Because of this simpler construction it sells at a lower price. Accurate temperature control is provided by the Cooley Selective Power Modifier (described in January *Metals Review,* page 13).

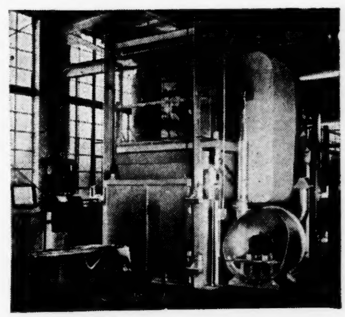


Sunbeam Stewart Electric Furnace for Preheating High Speed Steel

Annealing and Special-Purpose Furnaces

Dempsey Industrial Furnace Corp. **(573)** has developed a special elevator-type furnace for bright annealing copper bars in a steam atmosphere. The bars are used for electric motors and generators.

The furnace is mounted on wheels above a large water quench tank, in such a way that it may be shuttled



Gehnrich Oven for Annealing Coil and Sheet Aluminum

back and forth over two bases. The bases are mounted on elevator frames so that base and charge may be lowered and immersed in the quenching water. When raised, the base is sealed against the furnace bottom for heating; the second base may be raised above the water for loading.

Skirts completely surround the bottom portion of the furnace and extend below the level of the water in the quench tank, rendering the furnace completely tight for the steam atmosphere. Electric heating elements surround the charge, and a large motor-driven fan vigorously circulates the atmosphere.

The Gehnrich Oven Division of W. S. Rockwell Co. **(574)** has recently installed an oven for annealing coil and sheet aluminum. Production capacity is rated at 3000 lb. per hr. at a temperature of 850° F.

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found to have relatively high resistance to corrosion. Cr-Ni steels and Cu-Ni alloys exhibited good resistance. (To be continued.) (Presented at Annual Meeting, N.A.C.E., Chicago, April 7-10, 1947.)

6a-55. Cathodic Protection of Casings in Loudon Pool. S. P. Ewing and J. F. Bayhi. *Corrosion,* v. 4, June 1948, p. 264-286.

Results of investigation indicate that casings approximately 1500 ft. long can be protected by a current of 1.0 to 1.5 amp. (Presented at Annual Meeting, N.A.C.E., St. Louis, Mo., April 5-8, 1948.)

6a-56. Corrosion of Underground Steam Line Supports. Leo F. Collins, F. J. Schlachter, and G. D. Winans. *Heating and Ventilating,* v. 45, June 1948, p. 83-85.

Results of corrosion tests of 16 metals at seven different sites along the 40 miles of underground steam lines.

6a-57. Rust Prevention in Products Pipe Lines. E. W. Unruh and F. M. Watkins. *Oil and Gas Journal,* v. 47, June 17, 1948, p. 63-64, 67, 69.

Properties and uses of Sinclair RD-119, a new rust inhibitor recently developed and tested on a commercial basis.

6b—Ferrous

6b-48. Sur le Mecanisme de l'Oxydation Superficielle du Fer aux Temperatures Elevées. (The Mechanism of Surface Oxidation of Iron at Elevated Temperatures.) J. Benard. *Journal de Chimie Physique et de Physico-Chimie Biologique,* v. 44, Oct. 1947, p. 266-268.

The speed of growth of an oxide layer depends on two factors—the speed of interaction of iron and oxygen or of iron and oxides already formed; and the speed with which these elements reach the surface. The part played by each of the various oxides of iron in surface oxidation up to 1100° C.

6b-49. Cabos de Aco—Sua Inspeccao. (Steel Cables—Their Inspection.) Jaao Gustavo Haenel. *Boletim da Associacao Brasileira de Metais,* v. 4, Jan. 1948, p. 99-111.

Types of corrosion affecting steel cables. Methods for preventing or minimizing these. 12 ref.

6b-50. Drill-Pipe Failures, Inspection, and Protection in the Permian Basin. W. H. Crenshaw, V. B. Bottoms, C. N. Wallace, and C. R. O'Dell. *Petroleum Engineer.* v. 14, May 1948, p. 277, 278, 280, 282, 284, 286-288; *Oil and Gas Journal,* v. 47, June 10, 1948, p. 97-98, 100-101.

Some of the steps taken by drilling operators during the last two years toward reducing drill-pipe failures. (Presented at meeting of Southwestern District, A.P.I. Division of Production, San Antonio, Texas, April 14-16, 1948.)

6b-51. Effect of the Addition of Amines on the Electrode Potential of Copper in Buffered Acid Solution. Norman Hackerman and J. D. Sudbury. *Journal of the Electrochemical Society,* v. 93, May 1948, p. 191-198.

Extent of inhibitor adsorption on metal surface may be followed by observing the change in the electrode potential of the metal. It is postulated, based on large potential increments at low amine concentrations, that such inhibitors may be effective by decreasing the solution tendency of the most active metal spots. Total effectiveness however, is believed due to a combination of such decrease with cathodic effects and diffusion control. 12 ref. (Prepared for delivery at Columbus, Ohio, meeting of the Society, April 14 to 17, 1948.)

6b-52. La Passivation des Aciers Inoxydables et les Phenomenes d'Adsorption. (Passivation of Stainless Steels and Phenomena of Adsorption). L. Guitton. *Métaux & Corrosion,* v. 23, Feb. 1948, p. 29-33.

Results of experiments indicate that passivation of stainless steel is an adsorption phenomenon, the nature of which depends on the technique of passivation. Activation by preliminary attack of nascent oxygen makes it possible to obtain chemical combination, and produces a surface capable of resisting sulphuric acid corrosion. 14 ref.

6b-53. Corrosion: Its Effect in Boiler Systems. Part I. Robert L. Reed. *Combustion,* v. 19, May 1948, p. 28-33.

The theories of corrosion. The action of oxygen in the boiler system, its removal by mechanical and chemical means, and protection against its action in idle boilers. (To be continued.)

6b-54. Phillips Butane Dehydrogenation Process; Special Plant Investigations. George H. Hanson and Harrison L. Hays. *Chemical Engineering Progress* (Transactions Section), v. 44, June 1948, p. 431-442.

Suitability of various materials of construction for catalyst tubes operating at 1100° F. The original "harps" were made of 27% Cr steel. It was found that both 25-20 and 18-8 Si were equally satisfactory from both chemical and mechanical viewpoints.

6b-55. Cast Nickel-Molybdenum and Nickel-Molybdenum-Chromium Alloys for Severe Corrosion Services. Walter A. Luce. *Chemical Engineering Progress* (Transactions Section), v. 44, June 1948, p. 453-457; discussion, p. 457-458.

Data for high Ni-Mo and high Ni-Mo-Cr alloys with an alloy content of approximately 97%. Introduction of two alloys designated as Chlorimet 2 (Ni-Mo) and Chlorimet 3 (Ni-Mo-Cr). Results of many laboratory and plant investigations on corrosion resistance and application of these alloys.

6b-56. Effect of Atmospheric Corrosion on Maintenance and Economics of Overhead Line Hardware and Guy Strand. Part 3. (Series concluded.) C. J. Couy. *Corrosion,* v. 4, June 1948, p. 287-303.

Maintenance of guy strand, and data on tests to determine rates of diameter decay for areas of various pollution severity and relation of strength and corroded diameter. (Presented at Annual Meeting, N.A.C.E., Chicago, April 7-10, 1947.)

6b-57. Sui Metodi per Attenuare le Corrosioni Alle Canalizzazioni Metalliche Interrate. (Methods for Decreasing the Corrosion of Underground Pipes.) Oscar Scarpa. *La Metallurgia Italiana,* v. 39, Nov.-Dec. 1947, p. 261-266.

Results of investigation which show the effects of currents leaking from electric railway lines. Recommends use of special coating for the pipes.

6b-58. Etude Electrométrique de la Tenue des Aciers Inoxydables dans les Acides. (Electrometric Study of the Behavior of Stainless Steels in Acids.) M. L. Guitton. *Revue de Métallurgie,* v. 44, Nov.-Dec. 1947, p. 330-348.

A method for study of stainless Cr-Mn steel in 5% oxalic acid.

6b-59. Sur la Cinétique de la Réaction d' Oxydation du Fer dans sa Phase Initiale. (Kinetics of the Oxidation of Iron in Its Initial Phase.) Jacques Bénard and Jean Talbot. *Comptes Rendus* (France), v. 226, March 15, 1948, p. 912-914.

The Chévenard microbalance and a recording instrument were used to trace the oxidation-temperature curve in its initial phase. The curve of weight increase vs. time. The heat of activation corresponding to the oxidation of alpha iron, calculated from the curve, is about 59,000 cal.

6b-60. Investigation on Corrosive Matter in Meters. Stanley Jones and J. A. Speers. *Gas Times,* v. 55, May 21, 1948, p. 243.

Previously abstracted from *Gas Journal,* v. 254, April 7, 1948, p. 40. See item 6b-40, 1948.

6b-61. Corrosion in Isomerization of Light Hydrocarbons by Aluminum Chloride-Hydrocarbon Complex Catalyst. N. Fragen, C. W. Nysewander, and W. R. Hertwig. *Industrial and Engineering Chemistry,* v. 40, June 1948, p. 1133-1138.

Corrosion in the liquid phase isomerization of light hydrocarbons by aluminum chloride hydrocarbon complex catalyst causes penetration of carbon steel from 1 to 5 in. per yr. in the reactor, and reaches 15 in. per yr. at points of high turbulence. Lines and vessels handling reaction products exhibit penetration rates about one tenth of those in the reactor. Most successful means for minimizing corrosion involves the use of gunited Lumnite cement reactor liners and Hastelloy B reactor, nozzle, flange, and valve protection.

6b-62. Prevention of Corrosion in Refinery Heat Exchanger Equipment. M. A. Furth. *Petroleum Processing,* v. 3, June 1948, p. 549, 551-552, 554-555.

Types of crudes involved in particular systems, and their relative effects on corrosion; experiences in chemical neutralization of corrosive agents; types and effects of corrosion losses in shell-and-tube and submerged-bundle heat exchangers; types of metal alloys used to resist corrosion of various exchanger parts; and methods of application of such alloys.

6b-63. Pipe Corrosion Mitigation Practices. A. H. Cramer. *American Gas Journal,* v. 168, June 1948, p. 23-27, 58.

Underground pipe-protection practices followed by the Detroit district of Michigan Consolidated Gas Company and reports on field use of the Pearson Pipe Coating Fault Locator.

6c—Nonferrous

6c-14. Etude Electrochimique sur le Tantale Actif et Passif par la Methode des Piles. (Electrochemical Study of the Passivity and Activity of Tantalum by the Cell Method.) M. Haissinsky. *Métaux & Corrosion,* v. 23, Jan. 1948, p. 15-18; discussion, p. 18.

Results of a comparative study of electrochemical and other methods.

6c-15. Orientation des Films Minces d'Oxyde Cuivreux Formes sur le Cuivre. (Orientation of Thin Copperous Oxide Films on Copper.) Henri Frisby. *Comptes Rendus* (France), v. 226, Feb. 16, 1948, p. 572-573.

First, calls attention to a major error in a previous note (v. 224, 1947, p. 1003). Results of a study, by means of electron diffraction, of films formed on copper during immersion in boiling water.

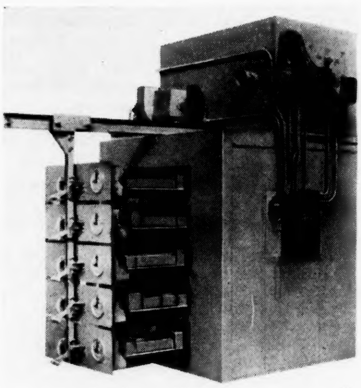
6c-16. Mechanism of Action of Bearing Corrosion Inhibitors in Crankcase Lubricants. J. D. Guttenplan and C. F. Prutton. *Lubrication Engineering,* v. 4, June 1948, p. 125-131; discussion p. 131.

Results of studies on oxidizing agents in oil which may be chemically or catalytically destroyed by the inhibitor, and on the formation

(*Turn to page 16*)

The work chamber is 5 ft. 6 in. wide by 19 ft. 3 in. long by 5 ft. 11 in. high, with interior chamber sheathing of stainless steel and exterior of black steel covered with heat resistant paint. Tracks on the oven floor will guide four-wheel work trucks. The heating and recirculating system is directly above the oven. A combination oil-gas burner uses either fuel or both.

An all-purpose drawer-type foundry oven has been designed by Despatch Oven Co. **(575)**. It is shipped assembled and can be installed by mainte-



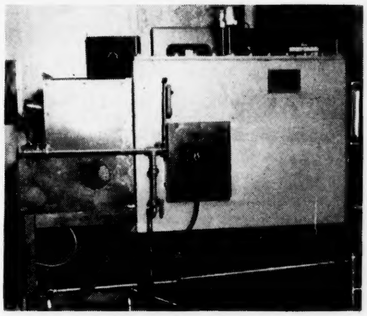
Despatch Foundry Oven

nance personnel in any factory. The fan and heater unit is enclosed in an insulated box which mounts on top of the oven body. A rugged but simple vertical support bar for the drawers does not interfere with loading from any angle. A rear plug on the drawer seals the oven against heat loss when the drawers are open.

Hardening Furnaces

A small furnace with air-actuated reciprocating hearth has been designed by C. I. Hayes, Inc. **(576)** for production hardening of small or medium-sized steel parts. The hearth feeder mechanism can be adjusted so that travel of work is controlled according to size and weight. The parts are quenched off the end of the moving hearth into a suitable quenching medium. The furnace can be used with the Hayes Type IG atmosphere generator described on page 17. It is available in capacities ranging from 50 to 200 lb. per hr.

Hardening of steel watch parts so small that millions of them may fill an ordinary teacup presents a major problem, successfully solved by Drever Co. **(577)**. The furnace is of the continuous type, electrically heated and gastight. Parts are conveyed through the furnace in two sloping and rotating alloy muffles.



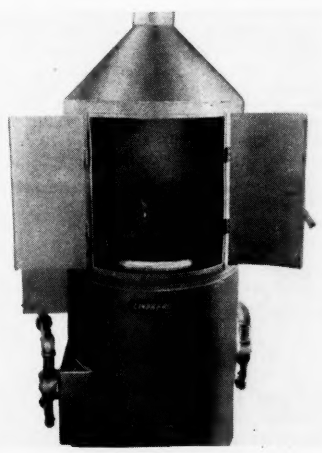
Drever 12-Kw. Continuous Hardening Furnace for Watch Parts

Each muffle is individually driven, the speed of rotation governing the proper heat treating cycle. An atmosphere of dissociated ammonia constantly purges the alloy tubes. The parts discharge into an oil quench chute and thence into a removable catch basket. The hardened parts are free from distortion and have a bright, clean surface.

Surface Combustion Corp. **(578)** has a new industrial bulletin on clean hardening furnaces, both continuous and batch types. Surface Combustion's balanced carbon oxides are used as the protective atmosphere, reducing scale and surface decarburization to a minimum.

Carburizing and Cyaniding

A new type of pot furnace featuring Hi-Life cyanide pots that carry a one-year guarantee has been announced by Lindberg Engineering Co. **(579)**. This is roughly equiva-



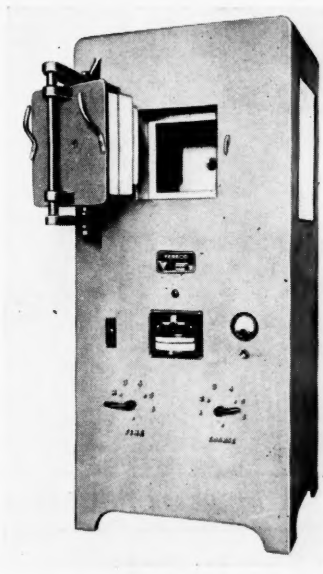
Lindberg Cyanide Pot Furnace

lent to 8000 operating hours. The one-year guarantee covers all Hi-Life pots used with cyanide or lead (neutral salts excluded) under automatic temperature control. The furnace is available in four standard sizes using pots 24x21 in., 20x21, 16x18, and 12x18 in.

A new bulletin by Holcroft & Co. **(580)** explains the operation and advantages of the gas carburizing process. Three typical gas carburizing installations are diagrammed and described. These include a two-row and a three-row continuous pusher-type furnace and an electrically heated single-row furnace for precision carburizing of small parts bulk-loaded in baskets.

Miscellaneous Ovens and Kilns

A new 32-page manual by Gehnrich & Gehnrich, Inc. (582) tells how to select industrial processing ovens. It discusses four basically different types of oven heating systems and when to use them, the various heating media, temperature and safety control, insulation, the materials handling problem, interesting ingenuities, the action of different products under heat, and the seven basic oven and heater types.



Pereny Laboratory Kiln

A laboratory kiln has been developed by Pereny Equipment Co. **(583)** as a complete unit, with all controls and operating mechanism contained in a single housing. This semi-muffle kiln can be heated up to 2700° F. in 2 hr. For flash firing the temperature limit is 3000° F. Heat is evenly distributed from eight Globar elements, baffled for maximum temperature uniformity.

Rogers Electric Kilns **(584)** has recently added five Master models,

(*Turn to page* 17)

For Bulletins and Further Information, Use Reader Service Coupon on Page 23

of surface film on bearing material by the inhibitor. 15 ref.

6c-17. Corrosion. Mars G. Fontana. *Industrial and Engineering Chemistry,* v. 40, June 1948, p. 103A-104A.

Results of an investigation of the mechanism of the unusually rapid oxidation of high-temperature, high-strength alloys that contain molybdenum, by W. C. Leslie and the author at Ohio State, under sponsorship of the Air Materiel Command. Most of the work dealt with a 16-25-6 (Cr-Ni-Mo) alloy.

6c-18. Inhibitor Action in Crankcase Lubricants. C. F. Prutton. *Oil and Gas Journal,* v. 47, June 10, 1948, p. 70-73, 103.

Functions of a crankcase lubricant, and details of the factors involved in producing a lubricant which will be relatively noncorrosive toward Cu-Pb alloy bearings.

6d—Light Metals

6d-13. Aluminum-Sheathed Power Cables. Part II. (Concluded.) *Engineer,* v. 165, April 30, 1948, p. 422-423.

Corrosion resistance and protective methods; also methods of installation.

6d-14. Sur la Cinétique de l'Oxydation du Magnésium. (Kinetics of the Oxidation of Magnesium.) Haldun N. Terem. *Comptes Rendus* (France), v. 226, March 15, 1948, p. 905-906.

The sudden increase in activity close to the point of combustion, observed by Pilling and Bedworth, was not confirmed by the present author, although there is a sudden increase as the combustion temperature is reached. The rest of the curve shows an induction period similar to that of Be and Al.

For additional annotations indexed in other sections, see:
23a-25; 23d-85.

CLEANING and FINISHING

7a—General

7a-120. Don't Overlook Small Savings. Mark G. Simpson. *Western Machinery and Steel World,* v. 39, May 1948, p. 81-83.

Unique tumbling-barrel design and special neoprene deburring compound. Greater efficiency in the deburring of small metal parts is claimed for the combination.

7a-121. Different Finishes on the Same Conveyer Setup. A. J. Berna. *Industrial Finishing,* v. 24, May 1948, p. 66-68, 70.

A 3-in-1 conveyer is used to move wood and metal parts through one spray booth and oven. Some parts receive three coats, some two coats, and some only one.

7a-122. Metal Cleaning Processes. Part IV. Solutions, Safeguards and Equipment. L. Sanderson. *Chemical Age,* v. 58, May 1, 1948, p. 613-615.

7a-123. Printing Replaces Hand Filling of Embossed Surfaces. H. O. Bates. *American Machinist,* v. 92, May 20, 1948, p. 109.

Corrected version of article which appeared in April 22 issue. See item 7a-98, 1948.

7a-124. Polishing—Its Role in the Metal Finishing Industry. W. L. Pinner. *Journal of the Electrodepositors' Technical Society,* v. 23, 1948, p. 95-100. (Reprint.)

Mechanical polishing as applied to the preparation of steel parts which are to receive a decorative coating of nickel and chromium plate.

7a-125. Organic Finishes for Metal Products. *Steel,* v. 122, May 17, 1948, p. 77-82; May 31, 1948, p. 56-59, 90; June 14, 1948, p. 96-98, 100, 102, 104.

1. Choice of the proper coating, application and baking methods, and metal-preparation techniques. 2. Methods of cleaning and preparing surfaces prior to painting, and to formation of phosphate coatings on steel. 3. Preparation for painting, including ways to determine whether or not a surface is clean. (To be continued.)

7a-126. An Investigation Into the Adhesion of Paint to Metal Surfaces. S. C. Britton. *Sheet Metal Industries,* v. 25, June 1948, p. 1185-1190, 1194.

Practical methods of improving adhesion, methods of determining adhesion in general use, and a method giving numerical results which is limited to effects of surface roughening treatments.

7a-127. Refractory Ceramic Base Coats for Metal. W. J. Plankenhorn. *Journal of the American Ceramic Society,* v. 31, June 1948, p. 145-153.

Formulation and development for application to ingot iron, low-carbon steel, and alloy metals. Tests for evaluation of the coatings and a summary of results. Metal preparation and procedures and results of service tests.

7a-128. Metal Cleaning. *Metal Finishing,* v. 46, June 1948, p. 113.

Table summarizes each of the more widely used techniques for cleaning metals prior to electroplating.

7a-129. Continuous Bonderizing Doubles Output. J. W. Lynch. *American Machinist,* v. 92, June 3, 1948, p. 87.

For finishing of electrical household appliances and lawn sprinklers requiring a number of steel stampings, and also painted aluminum and zinc die castings.

7a-130. Measurement of Adherence of Organic Coatings to Metal Surfaces. Henry Green and Theresa P. Lamattina. *Analytical Chemistry,* v. 20, June 15, 1948, p. 523-527.

An apparatus of the knife type, which cuts and pushes off a strip of coating of substantial width. The force necessary to do this is calculated in dynes and divided by the strip width to give a ratio called the stripping force per unit width. When this value is divided by the film thickness, the result is called the intrinsic stripping force.

7b—Ferrous

7b-95. Recent Developments in Tin and Tin Alloy Coatings. John Ireland. *Journal of Scientific and Industrial Research,* v. 6, Aug. 1947, p. 312-317.

Mainly concerned with work of the Tin Research Institute.

7b-96. Conditions for Passivation of Stainless Steels and Its Practical Application. L. Guitton. *Metal Treatment,* v. 15, Spring 1948, p. 3-13.

Passivation of stainless steels by chemical and anodic treatments, including sensitization. Laboratory samples and even shaped and welded parts may be perfectly resistant to normally corrosive media if passivated. 15 ref.

7b-97. Automatic Buffing Speeds Polishing. *Western Machinery and Steel World,* v. 39, May 1948, p. 80.

New semi-automatic rotary buffing machine. With six buffing heads in operation, only 12 sec. are needed for a 4-in. buff on the center, then 12 sec. for simultaneous top and bottom buffing.

7b-98. Trouble Shootin'. *Better Enameling,* v. 19, May 1948, p. 6-8.

Factors which may be responsible for trouble in the porcelain-enameling plant, and means for their rectification.

7b-99. Recommendations for an Enamel Plant Control System. Part II. John L. McLaughlin. *Better Enameling, v. 19,* May 1948, p. 16-17, 24-25, 32.

(To be continued.)

7b-100. Painting Refrigerators Electrostatically. G. P. Kennedy. *Industrial Finishing,* v. 24, May 1948, p. 38-40, 42.

Spray painting of doors and cabinets as they move by chain conveyor through an electrostatic field.

7b-101. Cleaning, Rustproofing and Painting Parts for Outdoor Metal Furniture. *Industrial Finishing,* v. 24 May 1948, p. 44-46, 48, 50, 52.

7b-102. Pullman's Production Setup for Painting Freight Cars. Walter W. Johnson. *Industrial Finishing,* v. 24, May 1948, p. 76, 78, 80, 84.

7b-103. High Temperature Ceramic Coatings for Steel Offer Many Potential Industrial Uses. *Steel,* v. 122, May 24, 1948, p. 104.

7b-104. Progress of Fluxing in Hot Galvanizing Practice. A. T. Baldwin. *Steel,* v. 122, May 31, 1948, p. 86, 88, 90.

Recent work on flux compositions and techniques. Wetting agents reduce surface tension in making up flux washes and create stable foams when flux is in fusion on molten zinc. (Presented at 20th meeting Galvanizers' Committee, St. Louis, April 15, 1948.)

7b-105. Anderung des Spannungszustandes der Werkstoffoberflache durch Atzen. (Changes in the Stress Condition of Surfaces Caused by Etching.) F. Lihl. *Archiv fur Metallkunde,* v. 1, Oct. 1946, p. 16-25.

Details of systematic research on heated soft-iron specimens. Pretreatment of the specimens and methods of photographing; surface stresses caused by use of different etchants and under different conditions; effects of heat treatment; effects of current density in electrolytic etching; superposition of etching stresses on stresses resulting from working or internal stresses.

7b-106. Essais de Préparation de Surfaces d'Acier avant Peinture. (Study of the Preparation of Steel Surfaces for Painting.) H. Baudot. *Métaux & Corrosion,* v. 23, Jan. 1948, p. 19-28; discussion, p. 28.

Painted panels were exposed to various conditions following various preliminary surface treatments. Results of four years' exposure.

7b-107. Protection de Surfaces Metalliques par la Resine Synthetique "Araldite". (Protection of Metallic Surfaces by Means of "Araldite" Synthetic Resin.) Gustave H. Ott. *Métaux & Corrosion,* v. 23, Feb. 1948, p. 41-46.

Mechanical and chemical properties of "Araldite 985" films of different thicknesses. Methods of use and applications, one of which is as a flexible-tube coating. Test panels after exposure to various chemicals for different periods of time.

7b-108. An Early Headache Becomes a Practical Movable Building. L. W. Ray. *Finish,* v. 5, June 1948, p. 18-22, 70, 73.

Development of the original por-

(*Turn to page* 18)

providing temperatures up to 1900° F. These kilns are encased in heavy gage steel for extra ruggedness, and have the pyrometer set in a slanting instrument panel in a ventilated base. The heating elements are recessed for maximum use of available space and free circulation of heat. On the average, the elements give better than 800 firing hours at 1900° F.

The Midget utility air heater has improved design features and is now available as a complete unit, according to Gas Appliance Service, Inc. **(585)**. In addition to the heater, the "package" includes fan, motor, drive, safety devices and temperature controller. The Midget has a heating capacity of 125,000 B.t.u. per hr., and is suitable for temperatures up to 350° F.

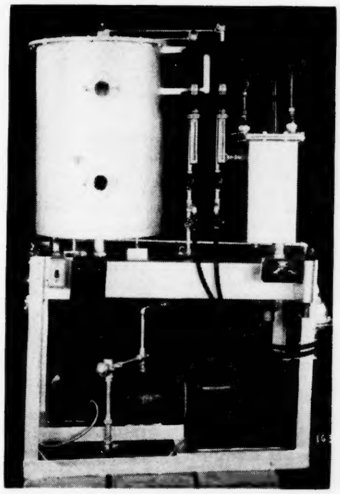
Controlled Atmospheres

Scale-free tempering and strain relief of metal parts is now being performed to an increasing extent by the Steam Homo Method, according to Leeds & Northrup Co. **(586)**. High speed steel, cast iron, sintered powdered iron compacts, and nonferrous alloys are being treated by this method at temperatures up to 1150° F.

A protective steam atmosphere is added to the well-known Homo forced-convection heating, and imparts a uniform blue oxide finish to the steel. Parts are free from scale, have improved machinability, increased resistance to corrosion and wear, and are easier to clean for subsequent plating. Steam from a process line or a small boiler is fed into the work chamber through an inlet in the bottom of the furnace. The equipment can also be run with natural air atmosphere if desired.

The new Urquhart Combustion Process is described in a four-page bulletin recently published by the Steel Processing Co. **(587)**. Conducted on a principle of atmosphere control which eliminates secondary combustion on the refractories and work, the process saves fuel, increases refractory life, and reduces maintenance costs. Since it produces uniformly heated steel, grinding, chipping and scarfing are reduced to a minimum.

The Urquhart process is being used in rotary hearth, slot-type forge and batch-type forge furnaces and soaking pits. Oil and gas can be used interchangeably as the fuel.

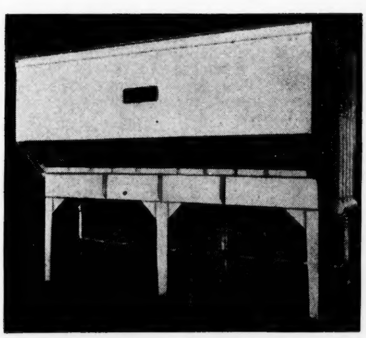


Hayes IG Atmosphere Generator

A new atmosphere generator developed by C. I. Hayes, Inc. **(588)** is known as the Type IG. From the combustion of city gas, natural gas, or bottled propane gas, with air, it produces an atmosphere high in CO and low in CO_2, with a controlled dew point. The generator has a removable combustion chamber mounted on a framework, with a water-jacketed cooling system. The standard cooling units are of the Frigidaire type, which maintain a controlled, low dew point on the output gas.

The equipment is used in standard tool furnaces for clean, scale-free hardening of carbon and alloy steels and high speed steels. It can also be used to produce a carrier gas for carbo-nitriding on conveyer-type continuous production furnaces.

The application of lithium atmospheres for scale-free heating of forgings has now passed the experimental stage, according to the Lithium Co. **(589)**, and while the process can be adapted to existing forge furnaces at a moderate cost, the company has designed and is now building special lithium atmosphere forge furnaces of both the double-slot and single-slot type. The furnaces are built in 11 standard sizes and are direct fired, utilizing oil or gas or a combination of both. The method of introducing the lithium vapor provides complete protection to the surface of the metal during heating and hot working.

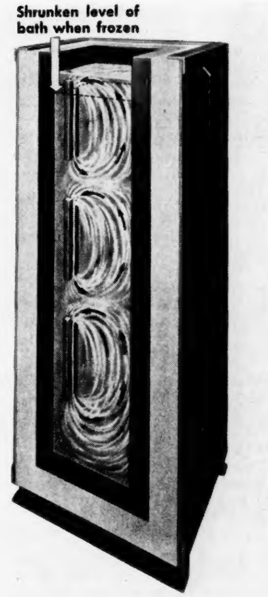


Double-Slot Lithium Atmosphere Forge Furnace

Salts and Salt Baths

Ajax Electric Co. **(591)** has developed a modified design of the well-known Ajax-Hultgren electric salt bath furnace in which the closely spaced electrodes are inserted through the sidewalls and are completely immersed in the bath. This submerged electrode design permits long work to be hung vertically. Electrodynamic circulation (indicated by arrows in the illustration) assures uniform bath temperature.

For deep furnaces several pairs of electrodes are cascaded, one above the other. If the salt should freeze because of power interruption or other cause, the shrinkage of the salt drops the level of the bath so that the top pair of electrodes is exposed a few inches. The bath can readily be restarted by melting a small salt area between these electrodes.



Ajax-Hultgren Vertical Salt Bath

Ajax has also developed a heat treating process **(592)** combining liquid carburizing with a martempering or austempering treatment. The desired case is produced in a liquid carburizing bath, and the work is then transferred to a neutral salt bath maintained just above the upper critical temperature of the case. This is followed directly by an isothermal quench. Toughness is thus added to the core while assuring a uniform hard case. The entire operation is carried out with one heating of the work.

(*Turn to page* 19)

celain-enameled, all-steel building—the White Castle hamburger stand—and gives evidence of its practicability.

7b-109. Forming Oxide Films on Electrical Steel. P. L. Schmidt. *Electrical Engineering*, v. 67, June 1948, p. 538. Digest of A.I.E.E. paper 48-120, "Formation of Oxide Films on Electrical Steel".

Process developed for consistently obtaining tightly adherent, highly resistant, blue-black, magnetic, iron oxide coatings at low temperatures on electrical-steel laminations to minimize interlaminar eddy currents.

7b-110. Service Trials of Painting Schemes Applied to a Steelworks Gantry. J. C. Hudson. *Journal of the Iron and Steel Institute*, v. 159, May 1948, p. 60-66.

Results of practical painting trials compared with those of small-scale outdoor exposure tests. Both agree in showing that the efficiency of the paint is greatly increased by removing the mill scale by pickling before applying the paint.

7b-111. Fabricating and Finishing Stainless Steel. Arthur P. Schulze. *Metal Finishing*, v. 46, June 1948, p. 103-109.

Blackening for appearance and additional corrosion resistance; miscellaneous operations such as soldering, brazing, and welding; and mechanical and chemical etching. Formulas, methods, and operating conditions.

7b-112. Improved Physical Properties of Titanium Enamels Provide Better Steel Finish. Burnham W. King. *Steel*, v. 122, June 21, 1948, p. 108, 111, 128, 130.

How scratch, abrasion and impact resistance, reflectance, opacity or hiding power, and resistance to chemical attack have been enhanced by continued development work in the use of titanium dioxide. Properties are charted vs. enamel thickness and other factors. 16 ref.

7c—Nonferrous

7c-18. Improving the Adhesion of Organic Finishes Over Zinc Plate. Roland E. Kohl. *Materials & Methods*, v. 27, May 1948, p. 83.

Use of a chromate dip prior to application of the organic finish, for parts and equipment to be subjected to severe conditions of temperature change and humidity.

7c-19. Barrel Burnishing Methods. *Die Castings*, v. 6, June 1948, p. 64, 66-67.

Materials, methods, and case histories for Zn or Al die castings.

7c-20. Ridge Formation on Tin-Plate. A. Hamelain. *Sheet Metal Industries*, v. 25, June 1948, p. 1125-1126, 1140.

Mechanism of formation of ridges and possible method of prevention.

7d—Light Metals

7d-24. Le Decapage Au Framanol; Nouveau Procede de Preparation des Surfaces et de Protection de l'Aluminium. (Pickling with Framanol; A New Process for Surface Preparation and Protection of Aluminum.) Jean Frasch. *Revue de l'Aluminium*, v. 25, March 1948, p. 84-89.

Use of a deoxidizing and degreasing solution for prewelding or preanodizing. Contact-resistance measurements and comparative effects of other pickling solutions.

7d-25. Brunak Anti-Oxidation Surface Treatment for Aluminum. Michael H. Bruno and Paul J. Hartsuch. *Printing Equipment Engineer*, v. 76, May 1948, p. 36, 42.

Previously abstracted from *Modern Lithography*, v. 16, April 1948, p. 51-53. See item 7d-19, 1948.

7d-26. Preparation for Painting of Aluminum Sheet and Plate. Part II. Chemical and Electrochemical Surface Treatments. R. H. Prislin. *Enamelist*, v. 25, May 1948, p. 24-31.

A descriptive review. 14 ref.

7d-27. Anodic Oxide Coatings; the Influence of Sealing Treatments on Protective Value. L. Whitby. *Metal Industry*, v. 72, May 14, 1948, p. 400-403.

Results of a comparative evaluation by salt-spray testing of the relative protective values of anodic oxide coatings on a fully heat treated duralumin-type alloy when subjected to various sealing treatments. 15 ref.

7d-28. Providing Aluminum With a Flexible Rust-Protective Coat and Paint Base. Norman P. Gentieu. *Machine and Tool Blue Book*, v. 44, June 1948, p. 164-166, 168, 170, 172, 174, 176.

"Alodizing" process.

7d-29. Surface Finishing of Aluminum and Its Alloys. *Aluminium Development Association* (London), *Information Bulletin* No. 13, Dec. 1947, 43 pages.

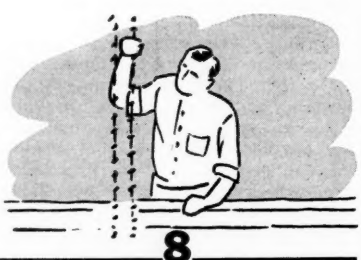
Cleaning and degreasing; mechanical, chemical, and electrochemical methods; and use of paint. Working processes such as shot blasting, pattern rolling, and hammer finishing; and also vitreous enameling and radiant-heat drying. 25 ref.

7d-30. Aluminum Coating of Steel. Armand Di Giulio. *Light Metal Age*, v. 7, June 1948, p. 8-9.

Procedure using electric salt-bath furnaces.

For additional annotations indexed in other sections, see:

6b-50; 14a-100; 16a-51; 21b-50; 27c-12.



8 ELECTRODEPOSITION and ELECTROFINISHING

8-124. Mechanism of Electrodeposition of Nickel. Part IV. Electrodeposition of Nickel During Direct Action of Atomic Hydrogen. (In Russian.) G. S. Vozdvizhenskii. *Zhurnal Prikladnoi Xhimii* (Journal of Applied Chemistry), v. 20, Dec. 1947, p. 1255-1260.

A method for experimental study of action during electrodeposition of metals is proposed. During electrodeposition of nickel, hydrogen participates directly in the formation of the structure of the electrodeposit.

8-125. The Use of Plastic Beads on Chrome Plating Tanks. Arthur C. Stern, Lawrence P. Benjamin, and Harry Goldberg. *Journal of the Electrochemical Society*, v. 93, May 1948, p. 67N-68N. A condensation.

The beads float on the surface of the plating bath and cause the bubbles of gas to escape at the surface of the liquid without bursting violently. They also provide a large wetted surface for entrapment of mist droplets.

8-126. Practical Method Developed for Plating on Magnesium. H. K. DeLong. *Materials & Methods*, v. 27, May 1948, p. 63-65.

The only difference from established plating procedures is the addition of a simple preliminary-immersion, zinc-coating step which is applied immediately after standard cleaning operations. It is a patented development.

8-127. Sur un Procédé d'Etude du Polissage Electrolytique. (Method for Study of Electrolytic Polishing.) I. Epelboim and C. Chalin. *Métaux & Corrosion*, v. 23, Jan. 1948, p. 1-4.

On the basis of a thorough investigation of P. Jacquet's method of electropolishing, it was found possible to determine optimum conditions from a plot of the variation in resistance of the electrolytic cell. 11 ref.

8-128. Emploi d'une Anode Tournante dans le Polissage Electrolytique du Cadmium et de l'Aluminium. (Use of a Rotating Anode in the Electropolishing of Cadmium and Aluminum.) Jacques Farran. *Metaux & Corrosion*, v. 23, Jan. 1948, p. 9-11.

Development of a satisfactory technique.

8-129. Electrozinc Phosphate Coatings for Iron and Steel. E. E. Halls. *Metallurgia*, v. 38, May 1948, p. 34-36.

Test results indicate that the combined process, in some cases, gives a better finish than is provided by phosphatization alone; and in others a better finish than that by phosphatizing over electroplated zinc coatings.

8-130. Electropointed Tungsten Wires. W. G. Pfann. *Bell Laboratories Record*, v. 26, May 1948, p. 205-208.

Solution of the problem of forming a point on a wire smaller in diameter than a human hair which arose in connection with the recent appearance of silicon and germanium point-contact rectifiers as circuit elements in microwave radar.

8-131. Tin Plating of Electro Shells; Application of Fluoborate Solutions. *Electrotypers & Stereotypers Journal*, v. 12, May 1948, p. 242, 244. Condensed from address by Clifford Struyk.

Detailed directions including bath compositions and preparation, and operating conditions.

8-132. The Hydrogen Ion. J. B. Mohler and H. J. Sedusky. *Metal Finishing*, v. 46, June 1948, p. 85-89, 152.

Fundamental principles of acids and bases, ionization of water, and buffer action; and their application to measurement and control of pH of electroplating baths. Colorimetric, electrometric, and titration methods for pH measurement.

8-133. Plating and Airline Efficiency. Joseph Albin. *Metal Finishing*, v. 46, June 1948, p. 90-94, 109.

A good example of how special plating requirements are performed in an efficient manner on aircraft-engine parts.

8-134. Electrolytic Pickling. Konrad Weller. *Metal Finishing*, v. 46, June 1948, p. 95-102.

The various methods developed for electrolytic pickling for scale removal and surface cleaning. 17 ref.

8-135. Experiences With the Rochelle Copper Plating Solution. N. A. Tope. *Sheet Metal Industries*, v. 25, June 1948, p. 1191-1194.

Work done on copper plating of large quantities of miscellaneous airplane-engine components. The coating is used for stopping-off during carburizing, the copper being machined from surfaces to be hardened.

(Turn to page 20)

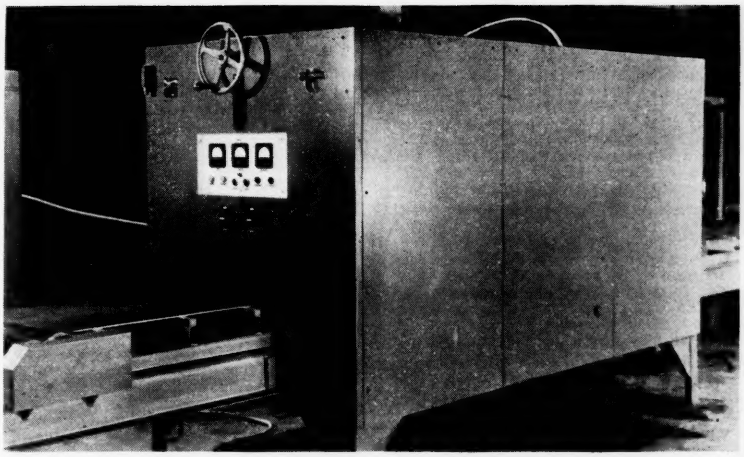
Commercial installations for this combination process are fully mechanized and only one operator is required. Work is carried on fixtures through the carburizing bath, neutral wash, isothermal quench and water wash and rinse tanks all in automatic sequence.

The Ajax-Hultgren salt bath furnace has also recently been commercially adapted to the aluminizing of steel products **(593)**. The parts are immersed in the molten salt bath, which acts as a flux to prepare the surface of the steel. The work is then passed through a layer of molten aluminum floating on the salt bath, and is thus simply and cheaply aluminized.

A continuous salt bath unit for neutral and cyanide salts, developed by Dempsey Industrial Furnace Corp. **(594)** is particularly applicable to the cyanide hardening of small parts. Another use is for heat treating small lots of different parts, which must be handled on varying cycles.

The assembly consists of two pot-type furnaces, a quench unit, a wash unit and dryer. Automatic handling equipment, hydraulically operated, loads the charges and transfers the work, finally delivering it, clean and dry, into a transfer box or other receiver, without manual handling. The batches handled range from 100 to 125 lb. per charge. Bath temperature and heating cycle may be varied from batch to batch. Furnaces may be of any desired type, heated by oil, gas or electricity.

A new carburizing salt, which is readily removed from oil quenched parts by immersion in hot water, is designated by E. F. Houghton & Co. **(595)** as Perliton "W". It is recommended for casehardening of hard-to-clean parts at temperatures up to 1575° F. It is also used as a replacement for straight cyanide. It is recommended that a starting salt known as Perliton 323 be used for melting down the bath. After the bath is ready for work, Perliton "W" is used for replenishments to compensate for dragout losses. A product data sheet giving the details is available.



Ther-Monic Foundry Core Baking Tunnel

Induction Heating

A new Ajax-Northrup induction heater, announced by Ajax Electrothermic Corp. **(596)** is designed to boost efficiency of forging operations. The heater is placed next to the forging machine and is used to reheat bars that have cooled too much during preliminary operations. It turns out one bar every 60 sec., timed right to the forging operation. The heater is self-contained and controlled by a foot switch. The unit illustrated will handle bars 4 in. square and up to a yard long, although heaters can be designed for practically any size job.

An indexing turntable for induction soldering, brazing or heat treating has been newly developed by Sherman Industrial Electronics Co. **(597)**. Work pieces are placed either manually or automatically on work holders, and all operations thereafter are electrically and air controlled. As many as 12 stations may be provided. Heating time of 1 to 60 sec. is controlled by an adjustable electric timer.

Indexing Turntable for Induction Heating by Sherman Electronics

Ajax-Northrup Forge Heater

The newest piece of equipment devised by Induction Heating Corp. **(598)** is a foundry core baking tunnel. Known as the Model M-800A, it has a capacity of 650 lb. of cores per hr., and will produce a ton of baked cores at a power cost of only 92c.

Green cores may be loaded directly onto the tunnel conveyor, and after the baking cycle may go directly onto the inspection table, eliminating much racking and handling. Green strength, hot strength, hardness, collapsibility, and other characteristics of the cores may be readily adjusted and controlled.

Advantages of induction heating in the form of increased production and lower processing costs are covered in a new 12-page bulletin issued by Allis-Chalmers Mfg. Co. **(599)**. The bulletin presents several dozen examples of brazing, soldering, hardening, annealing and heating with

(*Turn to page* 21)

8-136. Some Metallurgical Aspects of Electrodeposits. Carl E. Heusner, A. R. Balden, and L. M. Morse. *Plating,* v. 35, June 1948, p. 554-561, 577-578.

Porosity hardness, tensile strength, and brittleness. Data on mechanical properties of various deposits, hardness of electrodeposited metals and effect of addition agents on various properties. 10 ref. (To be continued.)

8-137. Stripping of Copper. Part V. Deplating in Cyanide Solutions. F. C. Mathers and E. L. Martin. *Plating,* v. 35, June 1948, p. 569-570, 575-576.

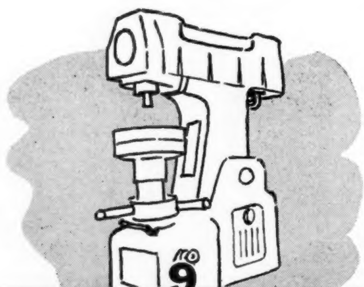
This part of the A.E.S. Research Project No. 1 concerns deplating of Cu from ferrous-base metals in cyanide solutions. A solution which is in commercial use and which is considered representative of the baths normally employed is used. Effects observed. 15 ref.

8-138. Thickness Standards for Cadmium Electroplate. George Black. *Product Engineering,* v. 19, June 1948, p. 165.

8-139. Thickness Standards for Zinc Electroplate. George Black. *Product Engineering,* v. 19, June 1948, p. 167.

8-140. Process Sheet for Anodizing Aluminum; Alumilite Sulphuric-Acid Method. George Black. *American Machinist,* v. 92, June 17, 1948, p. 141.

For additional annotations indexed in other sections, see: 7b-95; 11-155.



9 PHYSICAL and MECHANICAL TESTING

9a—General

9a-34. Testing, Instrumentation and Inspection. T. P. Nordin. *Metals Review,* v. 21, May 1948, p. 3, 5, 7, 9.

Reviews literature for past year. References to "A.S.M. Review of Current Metal Literature."

9a-35. Tools for Testing. *Metals Review,* v. 21, May 1948, p. 11, 13, 15, 17, 19, 21, 23.

A review of testing and inspection equipment for the metal industries introduced during the past year.

9a-36. Influence of Size and Shape of Specimens on Their Fatigue Strength. (In Russian.) I. A. Oding. *Collection of Reports Concerning the Dynamic Strength of Machine Parts,* Academy of Sciences of the U.S.S.R., 1946, p. 141-156.

"Dimensional factor" should not be considered by itself but only in connection with composition, crystal structure, heat treatment, and geometrical shape (also notch type, if present). 38 ref.

9a-37. Shape and Dimensional Factors Under the Influence of Alternating Stresses. (In Russian.) N. N. Afanas'ev. *Collection of Reports Concerning the Dynamic Strength of Machine Parts,* Academy of Sciences of the U. S. S. R., 1946, p. 157-167.

Formulas for the determination of "effective coefficient of stress concentration", which is defined as the relation between the fatigue strength of a plain specimen and that of a notched specimen of the same material. 20 ref.

9a-38. Influence of Dimensional Factors on the Propensity of Crystalline Bodies Toward Brittle Fracture. (In Russian.) F. F. Vitman. *Collection of Reports Concerning the Dynamic Strength of Machine Parts,* Academy of Sciences of the U.S.S.R., 1946, p. 168-177.

After thorough theoretical and experimental investigation, it was concluded that the fundamental cause of the presence of a dimensional factor is the impossibility of fulfillment of one of the conditions of similarity—namely a corresponding distribution of different defects. 25 ref.

9a-39. Statistical Theory of Dimensional Factors. (In Russian.) T. A. Kontorova. *Collection of Reports Concerning the Dynamic Strength of Machine Parts,* Academy of Sciences of the U.S.S.R., 1946, p.178-184.

Results of a theoretical investigation of the influence of the dimensional factor on the behavior of brittle materials in the critical brittleness interval.

9a-40. Method for the Absolute Measurement of Dynamic Properties of Linear Structures at Sonic Frequencies. W. James Lyons and Irven B. Prettyman. *Journal of Applied Physics,* v. 19, May 1948, p. 473-480.

Method, including theory, whereby dynamic stretch modulus, coefficient of internal friction, and hysteretic energy loss of textile yarns and cords can be accurately determined at longitudinal vibration frequencies above 100 cycles per sec. The method is applicable also to glass cords, and metallic wires and cables.

9a-41. Machine for Testing Gear Materials and Lubricants. *Machinery* (London), v. 72, May 13, 1948, p. 593-595.

New machine developed in Britain. The peripheries of two disks, rotating with either equal or different circumferential speeds, are pressed into contact under predetermined loads. Besides determining ultimate failure loads for materials and oils, the machine also permits determination of coefficient of friction between the disks under any operating conditions.

9b—Ferrous

9b-29. Cold Brittleness of Steel Under Tensile Stress. (In Russian.) D. M. Zagorodskikh. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 18, Jan. 1948, p. 85-88.

A series of tests performed on low-carbon steel specimens showed that the critical temperature of brittleness in impact bending does not change its value if specimens are under tensile stress, even close to the yield point, if both sides of specimen are clamped.

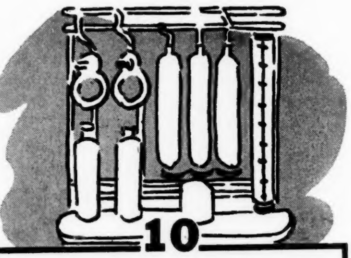
9b-30. The Meaning and Measurement of Transition Temperature. R. D. Stout and L. J. McGeady. *Welding Journal,* v. 27, June 1948, p. 299s-302s.

The writers believe that there has been too little consideration given to the part played by criterion for evaluating the "transition temperature" of the steels in interpreting fracture test results. Importance of this factor. 17 ref.

9b-31. Developments in High-Speed Rotating Disk Research at M.I.T. C. W. MacGregor and W. D. Tierney. *Welding Journal,* v. 27, June 1948, p. 303s-309s.

Development of the whirl pit and various auxiliary equipment for large-scale testing of steel plates under high-speed rotation. Results of pilot tests on disks having various methods of support, both welded and unwelded. Typical bursts and flow patterns.

For additional annotations indexed in other sections, see: 22b-168; 24b-70.



10 ANALYSIS

10a—General

10a-47. "Electrochronometric" Method of Analysis. Part I. (In Russian.) F. I. Trishin. *Zhurnal Analiticheskoi Khimii* (Journal of Analytical Chemistry), v. 3, Jan.-Feb. 1948, p. 21-28.

New general method in which the amount of the substance being determined is proportional to the time which elapses before a sudden increase in the potential of ionic solutions during potentiometric titration using a mercury cathode.

10a-48. Description of Automatic Recording Apparatus for Qualitative and Quantitative Determination of Ions on the Basis of Their Potential and Time Required for Their Separation at Constant Current Density. (Type I.) (In Russian.) F. I. Trishin. *Zhurnal Analiticheskoi Khimii* (Journal of Analytical Chemistry), v. 3, Jan.-Feb. 1948, p. 29-30.

10a-49. 1,2-Cyclohexanedione Dioxime; A Reagent for Nickel. Roger C. Voter, Charles V. Banks, and Harvey Diehl. *Analytical Chemistry,* v. 20, May 1948, p. 458-460.

One part of Ni in 10,000,000 may be detected with the reagent. Precipitation is complete at pH values of 3 and greater, and may be made from solutions of various anions. Separates Ni from Zn, Be, U, Al, the alkali and alkaline earth metals, Mn, Cd, Sb, and As. Attempts to separate Ni from Fe failed. 11 ref.

10a-50. The Effect of Variations in the General Composition of Samples in Spectrographic Analysis. G. O. Langstroth and D. Andrychuk. *Canadian Journal of Research,* v. 26, sec. A, March 1948, 39-49.

Variations that occur in intensity ratios belonging to pairs of elements on the addition of various extraneous substances to standard samples were studied using a common type of condensed spark discharge. The variations bore no apparent relation to relative ionization potentials or atomic weights of the test elements, nor to any physical property of the added substances.

10a-51. Percentages of Alloying Components in Metals Determined by Geiger Counter Type Unit. *Steel,* v. 122, June 7, 1948, p. 108.

(Turn to page 22)

Allis - Chalmers induction heaters, which range from 1 to 100 kw. in size. Attention is also called to the company's engineering service.

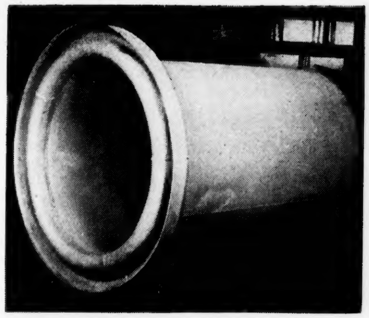
Furnace Materials

While no new compositions of heat resisting castings for furnace parts have been introduced recently, novelties in design have attracted considerable attention. As an instance, some large demountable heat treating boxes have been developed by Driver-Harris Co. **(601)** for a manufacturer of ball bearings. The problem here was to utilize an existing car-type furnace and make containers suitable for normalizing and heat treating miscellaneous work such as bearing race forgings.

A container of the required dimensions, if cast in one piece, would not only be of prohibitive wall thickness, but would not be free to expand and contract on heating and cooling. The container shown in the illustration is assembled by mortise joints, and is so designed that it can be lifted as one piece when necessary. The alloy is 35% nickel, 15% chromium, Type HT.

Driver-Harris Heat Treating Boxes

The Rolled Products Division of Michigan Steel Casting Co. **(602)** is supplying rolled sheets and plates of 35% Ni, 15% Cr Misco alloy for use by furnace builders and fabricators of heat treat equipment. Most designs use 3/16-in. thickness throughout, although sheet thicknesses from 1/8 to 1/4 in. are also utilized. Some retorts have a cast top sealing ring, while others (as shown in the photograph) are fabricated entirely from the rolled material. Many of these retorts have passed the 7000-hr. mark



Misco Pit-Type Furnace Retort

in carburizing atmospheres.

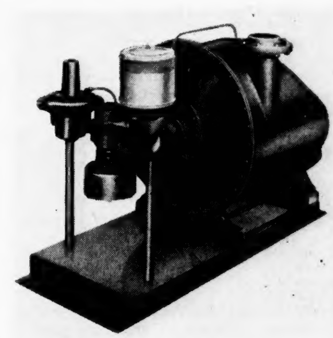
In the field of refractories, a high-strength, chrome-base refractory concrete, known as Kromecast, has been developed by the Babcock & Wilcox Co. **(603)**. It will withstand temperatures as high as 3100° F., and combines the refractory and slag-resisting properties of chrome-base materials with the ability to support loads at high temperatures. Kromecast can be poured into place as easily as ordinary concrete, or can be applied by plastering or with a cement gun.

Babcock & Wilcox Co. has also installed a new rotary hearth furnace used to heat billets for piercing in the manufacture of seamless tubing. The furnace, which is 27½ ft. in diameter with a 12½-ft. rotating hearth, is lined with lightweight insulating firebrick **(604)** instead of heavy firebrick. After a weekend shutdown, the furnace can be brought to temperature within 1½ hr., as compared with an 8-hr. heating-up period for furnaces lined with heavy firebrick. The lining materials used were lightweight B & W K-26, K-28 and K-20 insulating firebrick.

Another lightweight but strong insulating material is Kaylo Heat Insulating Block, recently released for peacetime applications by American Structural Products Co. **(605)**. It is a mineral insulation that performs effectively up to 1200° F. Weight is only about 11 lb. per cu. ft., and it can be sawed, cut, and scored with common woodworking tools. A four-page folder gives physical characteristics under various conditions and technical charts showing heat loss, surface temperatures, and efficiencies in varying degrees of thickness.

Burners and Mixers

The new Furkert gas-air mixer developed by Gas Appliance Service, Inc. **(606)** is designed to premix any



Furkert Gas-Air Mixer

commercial gas—natural, manufactured or liquid petroleum gases—with air in any desired proportion and in any quantity within the capacity of the unit. The mixture is delivered to the burners under constant pressure. It is particularly suited to such operations as automatic brazing and soldering, flame hardening, controlled atmosphere installations, and furnaces utilizing a high rate of heat input.

The mixture ratio is independent of fluctuations in gas pressure or changes in output demand. An inspection window in the air inlet enables the operator to check the unit's performance.

Bryant Heater Co. **(607)** has three new data sheets giving descriptions, capacities, dimensions and price list of burner and regulator assemblies. The first covers Bryant Cage Blast Burners—all-purpose burner assemblies that handle gas-air mixtures at any pressure; the second, unusual assemblies which combine burner nozzles, mixing units, mounting cages and burner blocks in various arrangements; and the third giving data on balanced gas regulators.

(*Turn to page* 23)

For Bulletins and Further Information, Use Reader Service Coupon on Page 23

New X-ray diffraction technique using a Geiger-counter-type fluorescence analysis unit.

10b—Ferrous

10b-32. Determination of Selenium in Steel. (In Russian.) N. A. Tananaev and V. I. Muracheva. *Zhurnal Analiticheskoi Khimii* (Journal of Analytical Chemistry), v. 3, Jan.-Feb. 1948, p. 3-6.

New gravimetric method utilizes slightly heated 1:4 H_2SO_4 for dissolution of the steel.

10b-33. Volumetric Determination of Trivalent Iron Using Tartrates. (In Russian.) A. V. Pavlinova. *Zhurnal Analiticheskoi Khimii* (Journal of Analytical Chemistry), v. 3, Jan.-Feb. 1948, p. 7-10.

Development of method which is based on reaction with $FeCl_3$ followed by titration of the acid formed.

10b-34. Determination of Small Amounts of Carbon in Steel; Evaluation of Low-Pressure Combustion Apparatus. John J. Naughton and Herbert H. Uhlig. *Analytical Chemistry,* v. 20, May 1948, p. 477-480.

The discrepancy between carbon values for the low-pressure combustion method and the standard combustion method was investigated. All results show the reliability of the former method.

10b-35. Rapid Routine Method for Testing Stainless Steels. J. B. Culbertson and R. M. Fowler. *Steel,* v. 122, May 24, 1948, p. 108, 110, 113.

Procedure using the Beckman spectrophotometer for determining the quantity of Cr, Ni, and Mn in stainless steels. (Presented at Analytical Symposium, Pittsburgh, Feb. 12-13, 1948.)

10b-36. Dosage Rapide du Cobalt dans les Aciers. (Rapid Determination of Cobalt in Steel.) B. Emile Jaboulay. *Revue de Métallurgie,* v. 44, Sept.-Oct. 1947, p. 302-306.

Cyanometric method differs from others in that tartaric or citric acids are not used, the iron being separated prior to the titration.

10b-37. A Study of the Cobalt-Ferricyanide Reaction With Relation to the Determination of Cobalt in Steel. B. Bagshawe and J. D. Hobson. *Analyst,* v. 73, March 1948, 152-157; discussion, p. 157.

Suitability of method for routine work, but authors found certain fundamental sources of errors which impair the value of the method where maximum accuracy is desired.

10b-38. Hydrogen, Nitrogen and Oxygen in Ferrous Metals. (Concluded.) E. C. Pigott. *Metallurgia,* v. 38, May 1948, p. 6-12.

Procedure for each of the four recognized methods for determining oxygen.

10b-39. Determination of Alumina in Iron Ore. G. Frederick Smith and F. Wm. Cagle. *Analytical Chemistry,* v. 20, June 15, 1948, p. 574-576.

New procedure involves formation of ferrous-bipyridine complex not precipitated by ammonium hydroxide or carbonate. Aluminum in small amounts can be separated from large amounts of iron in one precipitation.

10c—Nonferrous

10c-37. The Determination of Palladium and Nickel With Alpha-Furidioxime. Sherman A. Reed and Charles V. Banks. *U. S. Atomic Energy Commission,* AECD-1819, March 9, 1948, 8 pages.

Under optimum conditions 1 part of Ni was easily detected in 6,000,000 parts of an aqueous solution while 1 part of Pd in 20,000,000 parts of an aqueous solution was readily detected. Use as a quantitative reagent for Ni was not found to be feasible.

10c-38. Rapid Colorimetric Determination of Copper in Tin-Base Alloys. George Norwitz. *Analytical Chemistry,* v. 20, May 1948, p. 469-470.

After the sample has been dissolved in hydrochloric and nitric acids, phosphoric acid is added and the the solution is heated. Water and ammonia are added, and the resultant blue copper amine color is measured colorimetrically. Addition of phosphoric acid prevents precipitation of the tin when the solution is made ammoniacal.

10c-39. Organic Reagents for Uranium Analysis. Elinor Ware. *U. S. Atomic Energy Commission, MDDC* 1432, Aug. 1945, 20 pages.

Of the reagents studied, none combines exclusively with uranium. For colorimetric detection and determination, chromotropic acid and aluminon show the greatest sensitivity. Of the reagents that precipitate uranium quantitatively, 8-hydroxyquinoline seems unexcelled, although it is far from being an ideal reagent.

10c-40. Méthode de Titrage Semi-Electrométrique du Titane dans les Ferro-Titane. (Method of Semi-Electrometric Titration of Titanium in Ferro-Titanium.) Robert Lannet. *Revue de Métallurgie,* v. 44, Sept.-Oct. 1947, p. 286-291.

A modified method, said to be more useful for industrial work and to require simpler apparatus.

10c-41. A Method for the Determination of Minute Amounts of Zinc in Alloys Used for Making Lead Pipes and Cable Sheathing. B. S. Evans. *Analyst,* v. 73, March 1948, p. 149-152.

Details of volumetric method developed which is satisfactory for amounts as small as 0.001%.

10c-42. The Quantitative Spectrographic Analysis of the Rare Earth Elements. Part III. Determination of Major Constituents in Complex Mixtures. Velmer A. Fassel and Harley A. Wilhelm. *U. S. Atomic Energy Commission, MDDC* 1777, March 3, 1948, 8 pages.

Determination of Yt and Gd in the concentration range of 10 to 100%. The procedures involve the high-current, d.c.-arc excitation of rare-earth oxide sample. 18 ref.

10c-43. Influence de la Valence du Rhenium sur son Spectre X d'Absorption. (Influence of the Valence of Rhenium on Its X-Ray Absorption Spectrum.) Iona Manescu. *Comptes Rendus* (France), v. 226, March 22, 1948, p. 1010-1012.

10c-44. Spectrochemical Determination of Copper In Copper-Zinc and in Copper-Nickel Alloys. William M. Spicer. *Analytical Chemistry,* v. 20, June 15, 1948, p. 557-558.

The method is suitable for Cu from 70 to 97% in Cu-Zn alloys and 90 to 99% in Cu-Ni alloys.

10c-45. Analysis of Simple and Complex Tungsten Carbides. John J. Furey and Thos. R. Cunningham. *Analytical Chemistry,* v. 20, June 15, 1948, p. 563-570.

Methods for separating and estimating the principal constituents.

10d—Light Metals

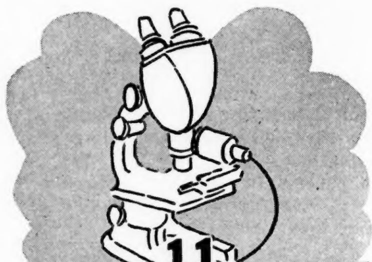
10d-12. Improved Gravimetric Determination of Silicon in Aluminum Alloys, Developed in Germany During the War. W. Stross. *Metallurgia,* v. 38, May 1948, p. 63-65.

Method, which is based on the mutual flocculation of gelatine and silicic acid, was tested and found to be a definite improvement on existing gravimetric procedures. 24 ref.

10d-13. Precipitation of Oxalates From Homogeneous Solution; Application to Separation and Volumetric Determination of Magnesium. Louis Gordon and Earle R. Caley. *Analytical Chemistry,* v. 20, June 15, 1948, p. 560-563.

Improved precipitation technique, by use of which the indirect method for determination of Mo based upon the solution of Mg oxalate in dilute H_2SO_4 and titration of the released oxalic acid becomes a very convenient and simple procedure.

For additional annotations indexed in other sections, see:
4b-42; 8-132.



11 APPARATUS, INSTRUMENTS and METHODS

11-129. Etude Des Structures Superficielles Au Moyen Des Rayons X. (Study of Surface Structures by Means of X-Rays.) Ch. Legrand. *Journal des Recherches du Centre National de la Recherche Scientifique,* No. 3, 1947, p. 147-151.

Techniques including necessary calculations. Application to the surfaces of metals and alloys for various purposes.

11-130. Une Methode Rapide de Preparation des Cristaux Uniques Metalliques. (A Rapid Method of Preparing Single Metallic Crystals.) Paul Lacombe and Louis Beaujard. *Journal de Chimie Physique et de Physico-Chimie Biologique,* v. 44, Oct. 1947, p. 269-273.

Previously abstracted from *Revue de Métallurgie,* v. 44, March-April 1947, p. 65-70. See item 11-219, R.M.L., v. 4, 1947.

11-131. Radiography in the Foundry. (In English.) R. Jackson. *Metalen,* v. 2, March 1948, p. 131-151.

Use in steel industry. Various defects revealed by X-ray and a comparison between mechanical tests and radiographic examination.

11-132. The Polarization Microscope. B. K. Johnson. *Endeavour,* v. 7, April 1948, p. 57-65.

Fundamental principles involved. Examples of its application to practical problems, especially in metallurgy, biology, and chemistry.

11-133. Practices and Trends in Steel-Mill Control. A. W. Schmitz. *General Electric Review,* v. 51, May 1948, p. 34-37.

Improvements made in amplidyne and electronic-control systems.

11-134. Direct-Reading Contact Scale for Analysis of X-Ray Spectrometer Charts. Wilfrid R. Foster. *Analytical Chemistry,* v. 20, May 1948, p. 489-490.

Its construction.

11-135. Metallurgical Books. (Contin-

(*Turn to page 24*)

A new mechanical fuel oil atomizer now in production by the Engineer Co. **(608)** has a capacity range of 10 to 1 without returning or recirculating oil, which is delivered to the atomizer at 300 psi. Output is varied by manual or automatic adjustment of a hand wheel.

Temperature Control

A new series of inexpensive temperature controllers designed for use with electric and gas heating units has been announced by K. H. Huppert Co. **(609)** under the trade name Infitrol. These stepless input controllers are available with or without pyrometers. Only a small portion of current is allowed through the heating elements, an amount sufficient to maintain definite temperatures. Since no resistance is used, no current is wasted. Gas equipment is controlled through a solenoid valve.

A complete line of high-accuracy thermocouple wire has been added by the Meter and Instrument Divisions of General Electric Co. **(610)**. Upon request, thermocouples will be assembled to meet requirements. A bulletin lists the various types of thermocouple wires and insulation materials in the new line, and gives data on application, selection and accuracy of thermocouple materials.

Use of thermoplastic insulation in place of rubber for thermocouple extension wire has several advantages, according to Brown Instrument Co. **(611)**. The over-all dimension of the wire can be reduced when thermoplastic insulation such as polyvinyl chloride is used, and therefore more wires can be run through a given conduit, or the size of the conduit can be reduced. Furthermore, the new insulation may be color-coded for safety with greater vividness and permanency than rubber.

Another Brown Instrument improvement is a skip-numeral print wheel **(612)** which, when used with strip chart electronic recorders, permits symmetrical and well-defined multiple measurement records.

Miscellaneous Products

New additives have been developed by the J. W. Kelley Co. **(613)** for its Beacon Branch quenching oil. The rate of quenching for this oil has been increased 50%, and the "H" value (heat extraction rate) increased from 0.75 to over 1.00. These new additives contain anti-oxidant qualities to reduce carbon and sludging.

J. W. Kelley Co. has also developed a neutral packing material **(614)** which maintains a neutral atmosphere, even in furnaces that are not atmospherically controlled. Punches, dies, tools and similar material may be pack hardened with complete immunity to oxidation and decarburization. Beacon Neutral Packing Compound is a granular, pea-size preparation that is free from dust and clean to handle.

Huppert Infitrol Controller

A fuel oil additive, designed to clean oil systems from tank to stack is a new development of E. F. Houghton & Co. **(615)**. This mixture, which has been given the name Houghto-Solv, takes the sludge into solution and makes it a burnable part of the fuel. It is added directly to the fuel tank in the ratio of 1 qt. to 1000 gal. of oil.

A new superficial hardness tester has been designed by Clark Instrument, Inc. **(616)** especially for testing surfaces that must not be marred, such as surface hardened steel. Depth of penetration with the Clark Superficial is held to limits of 0.005 in. or less. It is available in three models, of 8, 12 and 16-in. capacity.

READER SERVICE COUPON

Check These Numbers for Production Information and Manufacturers Catalogs. These following numbers refer to the new products and bulletins listed in the article on "Heat Treating Equipment" starting on page 13.

THIS COUPON IS VOID AFTER OCT. 15, 1948

Metals Review, July, 1948

569	574	578	583	587	592	596	601	605	609	613
570	575	579	584	588	593	597	602	606	610	614
571	576	580	585	589	594	598	603	607	611	615
573	577	582	586	591	595	599	604	608	612	616

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ued.) Sibyl E. Warren. *Metals Review,* v. 21, May 1948, p. 41, 43.

This section of classified bibliography of books published during 1936-46 covers metallography and heat treating. (To be continued)

11-136. Phase-Angle Determination in X-Ray Crystallography. Alexander R. Stokes. *Nature,* v. 161, May 1, 1948, p. 679-680.

A. D. Booth has suggested that a study of the diffuse reflections in X-ray diffraction photographs should give information as to the phase angles of the Bragg reflections. Two serious theoretical difficulties in this argument.

11-137. Eine Halbzylinderkamera zur Bestimmung kleiner Abstandsanderungen in Kristallgittern mittels Röntgenstrahlen. (A Semicylindrical Camera for Determination by X-Ray of Small Distance Variations in Crystal Lattices.) F. Gunther. *Archiv fur Metallkunde,* v. 1, Oct. 1946, p. 14-15.

Surveys the various methods and apparatus used.

11-138. Ein Beitrag zur Gitterkonstantenbestimmung und röntgenographischen Spannungsmessung an grob kristallinen Werkstoffen. (A Contribution to the Determination of Lattice Constants and the X-Ray Stress Measurement of Coarse Crystalline Materials.) F. Lihl. *Archiv fur Metallkunde,* v. 1, Oct. 1946, p. 25-31.

Reflex method using a revolving camera. Test results obtained in this way compared with those obtained by the "abpinsel" method—in which the sample and the camera are moved simultaneously with the revolving film, the distance being kept constant.

11-139. Beitrag zur Frage: Villardspannung oder Gleichspannung fur technische Röntgendurchstrahlungs-Einrichtungen. (Contribution to the Question: Villard Potential vs. D. C. Potential for Industrial X-Ray Rectification Equipment.) H. Verse. *Archiv fur Metallkunde,* v. 1, Oct. 1946, p. 32-36.

Data for the two types of circuits when used for the investigation of various metals. The Villard Circuit is a modified d.c. circuit.

11-140. On the Resolving Power of the Ordinary X-Ray Spectrograph and the Natural Width of X-Ray Spectral Lines. D. Coster and H. DeLang. *Physica,* v. 13, Aug. 1947, p. 379-384.

Resolving power based on the photographic method, using calcite as analyzing crystal, depends primarily upon the dimensions of the spectrograph. With the aid of a spectrograph of large dimensions, linewidths were determined.

11-141. Méthode d'étude des Equilibres Enchevetrés. (Method for Study of Complex Equilibriums.) Marcel Pourbaix. *Revue de Métallurgie,* v. 44, Sept.-Oct. 1947, p. 292-301; discussion, p. 301.

A graphical method in which two of the factors involved are charted along the ordinate and abscissa respectively; the other factors are considered as parameters. The characteristic equilibria thus appear as a family of lines, each of which corresponds to a definite value of the parameter. When the characteristic equilibria of the different reactions which are possible in a given system are charted on the same graph, the result is a complex system of many families of lines which forms a diagram which is useful in study of the system.

11-142. Le Micropolissage. (Micropolishing.) E. Knuth-Winterfeldt. *Métaux & Corrosion,* v. 23, Jan. 1948, p. 5-8.

New method particularly suitable for preparation of very small polished surfaces for microstructural examination.

11-143. An Adjustable Curved Crystal Monochromator For X-Ray Diffraction Analysis. P. M. De Wolff. *Applied Scientific Research,* v. B1, No. 2, 1948, p. 119-126.

An apparatus which minimizes aberration and requires no high-precision work in making a crystal holder; further, the monochromator can easily be set to a large range of wave lengths and crystal-to-focus distances.

11-144. Apparatus for Weighing in Vacuum. G. W. Monk. *Journal of Applied Physics,* v. 19, May 1948, p. 485-486.

Apparatus which can be used to measure the weight of a sample in a vacuum (0.01 micron) at temperatures up to about 700° C.

11-145. Effect of Recrystallized Grain Size on Grain Growth. Paul A. Beck. *Journal of Applied Physics,* v. 19, May 1948, p. 507-509.

Mathematical relationships are derived for slide rule calculation for both flat and cylindrical films.

11-146. Gear Testing. *Automobile Engineer,* v. 38, May 1948, p. 191-192.

Machine and method used in development of materials and lubricants which will allow higher surface stresses and greater tooth loads to be employed.

11-147. Photoelasticity. J. Ward. *Automobile Engineer,* v. 38, May 1948, p. 193-196.

Recent developments in an advanced testing technique. (To be continued.)

11-148. Servo-Control of a Testing Machine. Howard C. Roberts and Harold W. Katz. *Radio-Electronic Engineering,* (Bound with *Radio News,* v. 39), v. 10, May 1948, p. 6-9, 29.

A system for measuring, restoring, controlling, recording and adjusting a testing-machine load. (Condensed from paper presented at National Electronics Conference, Chicago, Nov. 3, 1947.)

11-149. Segregations and Inclusions; Their Study in Steel by Microradiography. W. Betteridge and R. S. Sharpe. *Iron and Steel,* v. 21, May 13, 1948, p. 242-245, discussion, p. 272-275.

Previously abstracted from *Journal of the Iron and Steel Institute,* v. 158, Feb. 1948, p. 185-191. See item 11-65, 1948.

11-150. Electron Diffraction for Film and Surface Studies. G. A. Doxey. *Electronics,* v. 21, June 1948, p. 112-113.

Crystalline structures of thin films can be determined by diffraction patterns produced when electrons are directed through the material. Surfaces of materials are studied by patterns of reflected electrons. Applications and equipment.

11-151. The Electron Microscope and its Application to Materials Problems. J. I. Wittebort. *Technical Data Digest,* v. 13, June 15, 1948, p. 9-20.

Theory, construction, operation, and applications.

11-152. Neutronen Durchleuchtung. (Neutron Radiography.) Otto Peter. *Zeitschrift fuer Naturforschung,* v. 1, Oct. 1946, p. 557-559.

Said to be the first time that radiographs were made by use of slow neutrons. The pictures lack the sharpness of those made with gamma rays, but they have certain new fields of application.

11-153. Präzisionsvergleich von Gitterkonstanten mittels Fraunhofer-Anordnung. (Precision Comparison of Lattice Constants by Means of the Fraunhofer Apparatus.) Gottfried Mollenstedt. *Zeitschrift fuer Naturforschung,* v. 1, Oct. 1946, p. 564-566.

New technique which corrects errors of earlier methods, especially disturbances caused by superposition.

11-154. Determination of Low Vapor Pressures at High Temperatures. Part 1. Vapor Pressure of Bismuth. (In Russian.) A. Granovskaya and A. Lynbimov. *Zhurnal Fizicheskoi Khimii* (Journal of Physical Chemistry), v. 22, Jan. 1948, p. 103-106.

New apparatus and data for bismuth in the range 450 to 700° C.

11-155. A Note on the Measurement of Plating Thickness. C. H. R. Gentry. *Analyst,* v. 73, March 1948, 157-158.

Modification of jet test devised by the British Non-Ferrous Research Association, in which the "penetration point" is detected by recording the change of potential on exposure of the underlying metal, of the half cell formed by the plated article in contact with the jet of reagent solution.

11-156. Sur l'Analyse Spectrographique de Substances Solides. (Spectrographic Analysis of Solid Materials.) Alain Berton. *Comptes Rendus* (France), v. 226, March 15, 1948, p. 892-894.

New arrangement of electrodes which provides a cavity for the powdered substance, in the lower electrode, and a simple electrical circuit and mechanical method for varying the temperature of the arc.

11-157. Design and Applications of a New Metals Comparator. D. E. Bovey. *Instruments,* v. 21, May 1948, p. 467-470.

Previously abstracted from *General Electric Review,* v. 50, Nov. 1947, p. 45-49. See item 11-198, R.M.L., v. 4, 1947.

11-158. Plastic Replicas for Surface-Finish Measurement. J. Pearson and M. R. Hopkins. *Journal of the Iron and Steel Institute,* v. 159, May 1948, p. 67-70.

Technique for the above.

11-159. The Fourier Method of Crystal Structure Analysis. W. Cochran. *Nature,* v. 161, May 15, 1948, p. 765.

Method of synthesis from observed X-ray reflection intensities.

11-160. Analyzing Graphical Records. Charles E. Balleisen. *Machine Design,* v. 20, June 1948, p. 145-149.

Practical methods of determining rates of change by graphical and numerical differentiation.

11-161. Beta Rays Make Better Gages. *Electronic Industries,* v. 2, June 1948, p. 19.

Use of radioactive isotopes in a new gage developed in the research laboratory of Goodyear Tire and Rubber Co. to measure sheets of Pliofilm and other thin films. The new gage reads accurately to a hundred-thousandth of an inch.

11-162. Radioactive Contaminants in Tracers; Origin, Detection, Identification and Removal. Waldo E. Cohn. *Analytical Chemistry,* v. 20, June 15, 1948, p. 498-503.

From the standpoint of the individual user. General causes, techniques and procedures involved. 39 ref.

11-163. Particle Size Determinations With Electron Microscopes. John H. L. Watson. *Analytical Chemistry,* v. 20, June 15, 1948, p. 576-584.

Important practical errors inherent in the methods of electron microscopy and how to minimize them, and procedures for securing semiquantitative data from electron micrographs.

11-164. Giant Pressure Vessel Built for

(*Turn to page 26*)

Reasons for Welded Ship Failures Embrace Several Engineering Fields

Reported by Leston B. Stark
Metallurgist, U. S. Navy Electronics Laboratory

A number of significant facts that resulted from the various studies on the reasons for welded ship failures during the war were presented before the San Diego Chapter A.S.M. at a recent meeting. Hugo Hiemke, design metallurgist for the C. F. Braun Co. of Alhambra, Calif., presented the lecture.

Mr. Hiemke initially emphasized that these studies embraced several major scientific and engineering fields. Physics of metals, mechanics, mechanical engineering and structural design theory were generally interrelated. The research studies were planned by the War Metallurgy Committee and directed by a special board appointed by the Secretary of the Navy.

Earl A. Kops (Left), Chairman of the San Diego Chapter A.S.M., Shown With Hugo Hiemke, Speaker on Welded Ship Failures

Of the 4694 merchant vessels constructed during the war (Liberty, Victory, tanker and other types), nearly all categories suffered both major and minor structural failures. A total of 24 ships suffered complete top deck fractures, or ½% of all the vessels constructed.

The original belief of the shipbuilders was that locked-up welding stresses were the major cause of failure, but the research program showed that they were not. The real object of the investigations was to discover why a normally ductile metal fails with a brittle fracture. Combined stresses, low temperatures, design features and the material itself all affect this type of fracture. The basic cause of the failures was finally pinned on a combination of faulty design (notches), faulty workmanship in welding, and steels which are notch sensitive at low temperatures.

Slides were shown of the ships Schenectady and Esso Manhattan, and also of 72-in. wide notched-tension tests conducted at the University of California structural testing laboratory.

During the course of the investigations, 20 ships went to sea with SR-4 strain gage systems aboard. There was a small reduction of the residual welding stresses in the welds. The deck stresses at a distance from the welds showed no change at all after six months of operation.

These studies involved a fine coordination of engineering research facilities to solve a complex practical problem.

Tests Show Value of Various Metallic Coatings

Reported by Maurice G. Steele
Kent Electric Corp.

C. H. Sample, chemical engineer with the International Nickel Co., New York, on May 2 addressed the members of the Rome Chapter A. S. M. on "Corrosion and the Protective Value of Metallic Coatings". He told how nickel, copper, tin, zinc and other metals may be used singly or in combination on metallic objects for the prevention of corrosion.

The speaker supplemented his talk with colored slides showing the results of protective coating tests conducted in the laboratory as well as in actual service.

The Reviewing Stand

THE IMPRESSIVE statistics we presented last month on the new volume of the A.S.M. Review of Metal Literature have an even more startling counterpart when we examine the newest addition to the A.S.M. book shelf—namely, the long-awaited 1948 edition of Metals Handbook. Nine years in the making, this "unabridged dictionary" sized tome contains over a million and a half words, 1444 8 x 11 pages (fine print too), 1590 illustrations, 975 tables, 803 titles, 603 contributors. It is roughly 40% larger than the 1939 edition which it supplants.

But let not the timorous reader turn hopelessly away from its ponderous size and weight, despairing of unearthing from that mass of scientific and technical data the information he specifically wants at the time he specifically wants it. Common among A.S.M. members who used the 1939 edition of the Handbook was the lament: "I know the information I want is in that book, but how the ———* can I find it!"

To overcome this really serious defect, the new book contains no less than seven different indexes, guides and tables of contents! What's more, a four-page looseleaf folder accompanying each copy of the book explains lucidly and explicitly just how to use these aids and how to take the shortest cut toward finding the particular kernel of information desired.

You are now, of course, consumed with eagerness to get your copy and try it out. The book is free to A.S.M. members, but you must return your old 1939 edition first. Turn to page 63 of this issue of Metals Review, and read the instructions thereon. They are simple but essential.

Questions We Can't Answer Department

More than a question but rather a nice little research problem is brought to our attention by a reader who has been trying to find a way to locate cracks in hard faced steel. His experiments were made on steel faced with stellite. To simulate conditions which exist in service, he induced cracks by repeated cycles of heating to 950° F. and water quenching. Because of the heat tinting which occurred at this temperature, the fine cracks produced were visible to the naked eye, but could not be demonstrated by the Zyglo process. Magnaflux, of course, was ineffective. Deep etching and electrical resistance methods have not yet been tried.

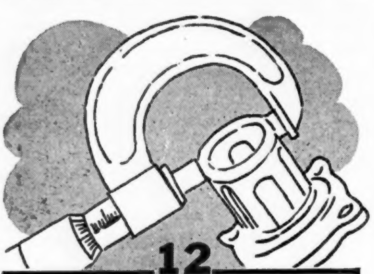
The department of metallurgical engineering of an eastern university is interested in procuring either hand or power-driven laboratory-size rolls. They should be capable of handling materials up to 1 in. thick, mostly nonferrous. Can someone lend a hand?

M.R.H.

* Metallurgical profanity censored.

Testing Navy Underwater Equipment. *Steel,* v. 122, June 21, 1948, p. 119.

For additional annotations indexed in other sections, see:
7a-130; 9a-34-35; 14c-40; 18a-12.



12 INSPECTION and STANDARDIZATION

12a—General

12a-57. Advancement in Industrial Radiography. Gerold H. Tenney. *U. S. Atomic Energy Commission,* MDDC-1491: LADC-420, Dec. 5, 1947, 3 pages.

12a-58. A Inspecao de Pecas Metalicas Pelos Raios-Gama. (Inspection of Metal Castings by Means of Gamma Rays.) Carlos de Revoredo Barros and Victor Lo Ré. *Boletim da Associacao Brasileira de Metais,* v. 4, Jan. 1948, p. 36-49.

Method and results of comparative study of X and gamma-rays. The latter are recommended for industrial use.

12a-59. The Standards Department—Its Organization and Function. Paul R. Godfrey. *Iron Age,* v. 161, May 27, 1948, p. 78-83, 148.

Contributions a standards department can make in reducing manufacturing costs and improving quality.

12a-60. Quality Control—The Preventative Medicine of Industry. L. Kasper. *Modern Machine Shop,* v. 21, June 1948, p. 124-130, 132, 134, 136, 138, 140.

12a-61. Process Control Steps-up Production, Cuts Costs. *SAE Journal,* v. 56, June 1948, p. 24-27. Excerpts from "Production Process Control, What It Can Do for Quality, Costs, and Volume," by R. H. McCarroll.

Examples of the use of statistical quality control in the foundry, in forging, in plating, and in cold-heading.

12a-62. Quality Control in a Tractor Plant. Joseph Geschelin. *Automotive Industries,* v. 98, June 1, 1948, p. 34-35, 66, 68, 70.

Adaptation of statistical methods to small-lot operations with highly beneficial results.

12a-63. Gaging and Metrology. John E. Sears. *Institution of Mechanical Engineers, Proceedings,* Vol. 157, War Emergency Issue No. 32, 1947, p. 298-301.

A review of progress in the above practice.

12a-64. Supersonic Inspection. *Welding Engineer,* v. 33, June 1948, p. 33.

Newly developed testing technique employing high-frequency supersonic waves entering the welded part at an angle. It is a modification of the technique of the Sperry Supersonic Reflectoscope and is known as angle-beam transmission. It can be applied to the inspection of welds in plate, thin sheets, or sections where shape or contour is more or less uniform, and also inspection of internal defects. It is applicable to both ferrous and light metals.

12a-65. Bore Inspection. *Aircraft Production,* v. 10, June 1948, p. 187-188.

New method for fine measurement of interrupted and soft-surfaced bores.

12a-66. Controlling Quality in Castings Production. V. A. Simpson and G. K. Eggleston. *American Foundryman,* v. 13, June 1948, p. 55-56.

A new approach to the problem of maintaining cooperation between production, metallurgical and inspection personnel, in their combined attempt to keep quality up and costs down.

12a-67. Testing Welds With Supersonic Waves. Benson Carlin. *Welding Journal,* v. 27, June 1948, p. 438-440.

Newly developed "angle beam" transmission technique in connection with a conventional Supersonic Reflectoscope.

12a-68. Shop-Run Tolerances. Part II. L. M. Nielsen. *Product Engineering,* v. 19, June 1948, p. 141-145.

Data for parts produced on screw machines and general machine-shop equipment. Eccentricity and angularity tolerances for parts threaded on screw machines.

12b—Ferrous

12b-36. The Spectrograph as an Aid to Quality Control. Hubert Swett. *Western Metals,* v. 6, May 1948, p. 40-42.

12b-37. The Practical Application of Hardenability Specifications. H. B. Knowlton. *Iron Age,* v. 161, June 3, 1948, p. 72-77, 158, 160.

Practical significance of minimum hardenability in regulating physical properties, and also the relation of minimum hardenability to per cent martensite. Effect of tempering on hardenability and recommends measurement of this relationship in the hardenability test specimens.

12b-38. High Duty Cast Iron in Great Britain. (In English.) A. B. Everest. *Metalen,* v. 2, May 1948, p. 193-194.

Deals mainly with specifications. (Summary of a lecture.)

12b-39. Specificatie en Normalisatie van stalen Walsproducten. (Specifications for Normalization of Rolled Steel Products.) P. M. Waszink. *Metalen,* v. 2, May 1948, p. 196-202.

Development of specifications for steel products which achieve a satisfactory compromise between the interests of the producer and the consumer. 11 ref.

12b-40. Magnaflux Inspection of Car Parts. R. H. Herman. *Railway Mechanical Engineer,* v. 122, June 1948, p. 86-98.

Use by Southern Railway.

12b-41. Two Million Volt X-Ray Machine. *Welding Journal,* v. 27, June 1948, p. 476.

Instrument to examine welds in high-pressure, high-temperature boiler drums.

12d—Light Metals

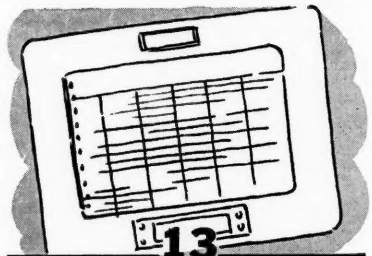
12d-8. Aluminum Alloy Control With the Quantometer. C. J. Clausen, Jr. *Western Metals,* v. 6, May 1948, p. 26-29.

Use in rolling-mill laboratory.

12d-9. Tentative Specifications For Aluminum-Base Alloy Sand Castings: ASTM Designation: B26-47T *Foundry,* v. 26, June 1948, p. 227-228.

(To be concluded).

For additional annotations indexed in other sections, see:
6b-50-63; 8-138-139; 9a-34-35; 11-131; 27a-79.



13 TEMPERATURE MEASUREMENT and CONTROL

13-26. Labile Thermoregulator. (In Russian.) K. G. Kumanin. *Zhurnal Prikladnoi Xhimii* (Journal of Applied Chemistry), v. 20, Dec. 1947, p. 1242-1247.

A new method of thermal analysis based on the principle of automatic retention of constant temperature differences between the wall of the furnace and the weighed portion of the investigated substance.

13-27. Progress and Pyrometry. O. B. Wilson. *Industrial Heating,* v. 15, May 1948, p. 764, 766, 768, 770.

The role of instrumentation in industry and the types of recording and controlling instruments, taking first the millivoltmeter type, then the potentiometer type, and finally modern electronic devices. (Presented at recent meeting of Berkshire Society for Metals, Pittsfield, Mass.)

13-28. Compensating Millivoltmeter Pyrometers for Ambient Temperature Changes. R. H. Grant and J. T. Cataldo. *Instruments,* v. 21, May 1948, p. 448, 450, 452, 454.

Describes construction and use as well as theory.

13-29. Design of Temperature-Measuring Elements. Mario T. Cichelli. *Industrial and Engineering Chemistry,* v. 40, June 1948, p. 1032-1039.

Methods for determining the length of temperature-measuring elements that must extend into a gaseous atmosphere to reduce the error of reading, due to conduction of heat along the unit, to less than a certain value.

For additional annotations indexed in other sections, see:
9a-34-35.

(*Turn to page* 28)

Metal Congress Will Feature a "Salute To Alloy Steels"

A "Salute to Alloy Steel", in celebration of 75 years of progress, will be the central theme at the National Metal Congress and Exposition when the American Society for Metals holds its 30th annual convention in Philadelphia, Oct. 25 through 29.

Principal features of this diamond jubilee for alloy steel will be: (a) a program of technical and historical papers about alloy steel; (b) presentation of "Distinguished Service Awards" to individuals who have made outstanding contributions to the progress and development of alloy steels; (c) a dramatization of the part played by alloy steels in the history and development of the United States. This third feature will include graphic evidence of the dependence of the American economy on alloy steel as well as the progress of alloy steels in relation to the engineering, research and technology utilized in their development.

Three important committees, each composed of men who represent both the producing and consuming industries in alloy steel, have been chosen to work out the program of the celebration. One committee will consist of presidents of steel companies and manufacturing associations—the latter covering aircraft, automotive, electrical equipment, farm equipment, machine tools, petroleum and railroad fields, as well as the Iron and Steel Institute. This group will serve with representatives of Government who are large users of alloy steels, as the honorary committee.

The second committee will act on the awards to living individuals who can justifiably be honored for their contributions to progress in the realm of alloy steels. This committee will consider nominations submitted to it and select outstanding men in all branches of alloy steels for the awards. A form for entering nominations for the awards will be published in the August issues of both *Metal Progress* and *Metals Review*

The third committee's responsibility will be to dramatize the history and progress of alloy steel by a visual display of products, applications and services. This dramatic display of alloy steel products will illustrate the use of these important steels in providing the higher living standards we now enjoy.

This salute will pay a deserved tribute to the many companies and their metallurgists who have made alloy steels a major factor in our national progress, according to W. H. Eisenman, national secretary of the American Society for Metals. The 20,000 A.S.M. members are representative of the producers and consumers of alloy steel, and the society's 30 years of service to the metal industries have paralleled the period of greatest advances in alloy steel.

The activities planned for this "Salute to Alloy Steels" will supplement the technical programs, lecture courses, exhibits and other events that traditionally constitute the National Metal Congress and Exposition. Cooperating societies that will sponsor individual technical programs are the American Society for Metals, sponsor of the Congress, the American Welding Society, the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, and the Society for Nondestructive Testing. Information concerning headquarters hotels and an application for reservations will be found on page 61.

Change in Constitution and Bylaws Concerns Distribution of Publications

To conform with the present method of distributing the *Transactions* of the American Society for Metals, a change in the constitution and bylaws of the national society has been proposed. Originally, the *Transactions* was published as a monthly and mailed to all members of the society in good standing. The paper shortage and rapidly rising publication costs of the war and postwar years have made it expedient to publish the *Transactions* as an annual volume and to send it only to those members who request it.

However, the constitution of the American Society for Metals requires that the annual reports of the president, the secretary and the treasurer (heretofore published only in the *Transactions*) shall be brought to the attention of *all* members of the society. The proposed change in the constitution will permit that these reports be printed in other publications of the society, which normally go to all members, as well as in the *Transactions.*

The proposed change in the constitution has been approved by both the Board of Trustees and the Constitution and Bylaws Committee, and will be presented to the members of the society at the annual meeting in Philadelphia on Oct. 27. The wording of the present constitution is shown in the left-hand column below, with the revised wording in the right-hand column.

The members of the Constitution and Bylaws Committee are: D. D. Beach, chairman (Georgia Chapter), R. F. Harvey (Rhode Island Chapter), Milo J. Stutzman (Kansas City Chapter), A. S. Jameson (Chicago Chapter), William W. Wight (Hartford Chapter), and Arthur E. Focke, representing the Board of Trustees.

ARTICLE XI

PUBLICATIONS OF THE SOCIETY

Present Constitution

Publications

Section 1. The Board of Trustees shall publish a journal to be known as *Transactions* which shall be mailed to all members of the society in good standing or to designated representatives of member firms or corporations. *Transactions* shall be the official paper of the society. The Board of Trustees may publish and distribute such other publications or literature as it may from time to time determine.

Subscriptions

Section 2. The Board of Trustees may accept subscriptions to *Transactions* and other publications of the Society from persons who are not members of the society and shall fix the prices of such subscriptions.

Contents of Official Paper

Section 3. *Transactions* shall contain the annual report of the president, secretary and treasurer, together with such other scientific articles and such other items of interest and usefulness as shall be approved by the Publications Committee.

Proposed Changes

Publications

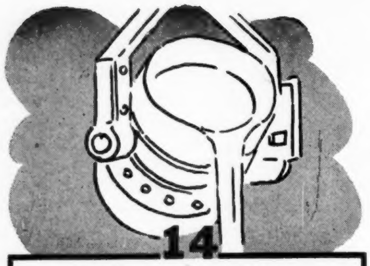
Section 1. The Board of Trustees shall publish *Transactions* and may publish and distribute such other publications and literature as it may from time to time determine. At least one publication of the society shall be distributed, not less frequently than once each month, to all members of the society in good standing or to designated representatives of member firms or corporations.

Subscriptions

Section 2. The Board of Trustees may accept subscriptions to publications of the society from persons who are not members of the society and shall fix the prices of such subscriptions.

Contents of Publications

Section 3. The publications of the society shall contain such scientific articles and such other items of interest and usefulness as shall be approved by the Board of Trustees or by such committees as the Board may appoint. The annual reports of the president and the secretary and the treasurer shall be published in the *Transactions* and also in one of the publications of the society which reaches all members of the society as referred to in Section 1 above.



FOUNDRY PRACTICE

14a—General

14a-93. Método de Estudo na Operacao de Estufamento dos Machos. (Method of Investigation of the Process of Core Drying.) Herbert H. Fairfield and Carlos Dias Brosch. *Boletim da Associacao Brasileira de Metais,* v. 4, Jan. 1948 p. 67-73.

Use of a time-temperature diagram for graphic analysis of the process. Such a diagram is believed to be of value for industrial control.

14a-94. Po de Carvao Vegetal como Adicao na Areia de Moldagem. (Charcoal as an Addition to Molding Sand.) Tomio Kitice. *Boletim da Associacao Brasileira de Metais,* v. 4, Jan. 1948, p. 94-98.

Results of an investigation for the purpose of cost reduction. Photomicrographs showing structure of the cores thus made.

14a-95. A New Range of Molding Machines. J. H. Hufton. *Foundry Trade Journal,* v. 84, April 29, 1948, p. 419-420, 425.

British-made hydraulically-operated machines for large boxes.

14a-96. Feeding Castings; A New Approach. S. T. Jazwinski. *American Foundryman,* v. 13, May 1948, p. 75-80.

A pressure greater than atmospheric is introduced into the feeder head by means of a special compound suspended therein in a small container. When the heat penetrates this container, gas is evolved which forces the molten metal into the casting. The desired action depends primarily on directional control of freezing by means of pressure gradient. (Presented at 16th Annual Foundry Practice Conference Birmingham District Chapter, A.F.A., Birmingham, Ala., Feb. 12-14. 1948.)

14a-97. Designing Strainer Cores. H. L. Campbell. *American Foundryman,* v. 13, May 1948, p. 107-108.

Proposes seven standard shapes and sizes for the above foundry industry. They are employed to control discharge of metal from pouring basins or to regulate flow of metal in gating systems. (Presented at 52nd annual meeting, A.F.A., Philadelphia, May 3-7, 1948.)

14a-98. Variable Properties Found in Western Bentonites. E. C. Troy. *American Foundryman,* v. 13, May 1948, p. 111-112.

Results of experimental work over a period of years conducted in order to aid in making allowance for variable properties when compounding sand mixtures.

14a-99. Foundry Shakeouts; Advantages From a Production Angle. *Iron and Steel,* v. 21, May 1948, p. 165-166.

Machines for knocking sand out of the molding boxes.

14a-100. Röntgendiaskopische Bewertung von Zinn- und Zinn-Austauschuberzugen auf Kernstutzen. (X-Ray Evaluation of Tin and Tin-Replacement Coatings on Core Supports.) H. Reininger. *Archiv fur Metallkunde,* v. 1, Oct. 1946, p. 39-48.

Requirements for foundry practice. Test results for a variety of conditions and replacement metals. 39 ref.

14a-101. Eine kolloidchemische Theorie uber anorganische Bindemittel der Formsande. (A Colloid-Chemical Theory of Inorganic Molding-Sand Binders.) H. Reininger. *Archiv fur Metallkunde,* v. 1, Jan. 1948, 63-73.

A theory was developed which accounts satisfactorily for the behavior of both foundry sand and binder materials. The theory is believed to be of practical value for the development of synthetic inorganic binders. 31 ref.

14a-102. Verfahren und Einrichtungen zur technologischen Untersuchung der Form-und Kernsande. (Methods and Apparatus for Research on Molding and Core Sands.) L. Jenicek. *Archiv fur Metallkunde,* v. 1, Jan. 1948, p. 83-94.

Special methods and equipment for determination of moisture, gas permeability, bending strength, and wear resistance.

14a-103. Molten Metal for Gravity Dies. *Light Metals,* v. 11, May 1948, p. 231-233.

Current methods of production in gravity die foundries, with reference to improvements offered by the recently introduced "Reverbale" furnace, which incorporates in one unit a reverbatory melting chamber and three bale-out stations.

14a-104. Vorman en Gieten in Cementzand. (Molding and Casting in Cement Sand.) H. Achatz. *Metalen,* v. 2, April 1948, p. 165-171.

Producing castings up to 40 tons in weight. Preparation, properties, and applications of cement sand.

14a-105. Westinghouse is Operating an Automatic Molding Unit. John A. Sharritts. *Foundry,* v. 26, June 1948, p. 78-85, 216, 218, 220, 222, 224.

14a-106. Factors Influencing Core Baking. E. C. Troy. *Foundry,* v. 26, June 1948, p. 92-95, 252, 254, 256.

14a-107. New Alloy Foundry Typifies Modern Design, Pat Dwyer. *Foundry,* v. 26, June 1948, p. 104-109, 270, 272, 274.

Layout, equipment, and procedures.

14a-108. Screwball Ideas Sometimes Work in the Foundry. J. W. Horner, Jr. *Foundry,* v. 26, June 1948, p. 91, 238, 240.

14a-109. Precision Casting at Allis-Chalmers. *Iron Age,* v. 161, June 3, 1948, p. 82-85.

Some notes on equipment and techniques for producing castings by the lost-wax process.

14a-110. Simplified Methods and Improved Equipment Advances Precision Investment Casting. K. J. Yonker. *Steel,* v. 122, June 7, 1948, p. 96-99.

Improvements since 1943, include use of machined-steel dies instead of Sn-Bi alloy cast around a brass or steel pattern; two improved types of injection machines; and use of 35-lb.-capacity, 9600 cycle, induction furnaces.

14a-111. La Fusione di Precisione. (Precision Casting.) E. D'Amico. *La Metallurgia Italiana,* v. 39, Nov.-Dec. 1947, p. 247-260.

Modern methods and applications.

14a-112. Dry-Sand Patterns. James Timbrell. *Foundry Trade Journal,* v. 84, May 13, 1948, p. 457-461.

A method which will ease problems in patternmaking for smaller jobbing foundries.

14a-113. Patterns From Casting Resins. Robert W. Shaeffer. *Tool Engineer,* v. 20, June 1948, p. 31-32.

Technique and procedures for making foundry patterns from synthetic resins.

14a-114. Casting Metals in Ceramic Molds. W. P. Gillingham. *Compressed Air Magazine,* v. 53, June 1948, p. 135-138.

"Lost-wax" process.

14a-115. Plastic Pattern Equipment. Steve Denkinger. *American Foundryman,* v. 13, June 1948, p. 43-45.

14a-116. Foundry Methods Improve Investment Casting. Kenneth R. Geist. *American Machinist,* v. 92, June 3, 1948, p. 83-86.

Improvements in manufacture of buckets for aircraft turbo-supercharger rotors by "lost wax" process.

14b—Ferrous

14b-69. Magnesium Equipment for an Iron Foundry. A. J. Marotta. *Modern Metals,* v. 4, May 1948, p. 26-27.

See abstract from *Foundry,* v. 76, Feb. 1948, p. 208-210, 212, 214. See item 14b-25, 1948.

14b-70. Cupola Operations Improved With Oxygen-Enriched Blast. W. C. Wick. *American Foundryman,* v. 13, May 1948, p. 64-74.

Use of oxygen has proven successful for increasing melting rates and tapping temperatures with a given coke ratio and blast volume. Most important of all, oxygen is useful in overcoming bridging and cold metal conditions and often can be used to save a heat from freezing in the furnace, and as a control to regulate melting rate and tapping temperature.

14b-71. Pattern Equipment; Mechanized Production of Light Castings. James A. McIntosh. *American Foundryman,* v. 13, May 1948, p. 81-83.

Previously abstracted from *Foundry Trade Journal,* v. 83, Dec. 18, 1947, p. 327-330. See item 14b-12, 1948.

14b-72. Slag Control is Important in Cupola Operation. *American Foundryman,* v. 13, May 1948, p. 109-110.

Third of a series dealing with modern cupola operation, sponsored by the Cupola Research Committee of A.F.A. Flux-material additions, iron oxide in slag, effect of slags on grain size, and slag color as a control factor. 11 ref.

14b-73. Formmassor for rasandsgjutning av Stal. Laboratorieundersokningar over Egenskaper vid Rumstemperatur. (Green Sand for Steel Casting. Laboratory Investigation of Properties at Room Temperature.) Karl-Gustaf Sandstrom. *Jernkontorets Annaler,* v. 132, March 1948, p. 59-90.

How green strength and permeability of the sands change with percentage of water and binder and with time after ramming. The sands investigated were chiefly composed of crushed sandstone or fine-grained silica sand and the following binders: cereal, dextrin, sulphite lye, water-glass, pine resin, and bentonite.

14b-74. The Loam Molding of Rope-Barrel Castings. D. Robertson. *Foundry Trade Journal,* v. 84, April 29, 1948, p. 413-418; May 6, 1948, p. 445-447; discussion, p. 447-448.

Methods used in casting of 20-ton cable drums for floating cranes. (Presented at meeting of Bristol and West of England Branch, Institute of British Foundrymen.)

14b-75. The Newcast Foundry. A. R. Parkes. *Foundry Trade Journal,* v. 84, May 6, 1948, p. 441-444.

Layout and facilities of British foundry.

14b-76. Oxygen and Cupola Operation.

(*Turn to page* 30)

Panel Session on Modern Heat Treatment Includes Salt Baths, Induction, H-Bands

Reported by C. L. Lundgren
Plant Metallurgist, Acme Steel Co.

"Modern Trends in Heat Treatment of Steel" was the topic of a panel session sponsored by the Chicago Chapter of the American Society for Metals at the Chicago Technical Conference last March. The session was conducted by Chapter Chairman A. S. Jameson, and was divided into three discussions. The first, on "Trends in Induction Heating" was led by H. B. Osborn, Jr., of the Ohio Crankshaft Co.

In a rapid-fire presentation, Dr. Osborn discussed the development of induction heating from its earliest stages to the present motor-generator, spark-gap and vacuum-tube oscillating types of equipment now employed. The advantages of induction heating include high production with correspondingly low labor costs, uniformity of heating, elimination of oxidation and the possibility of substituting carbon steels for alloy steel applications in hardening.

Dr. Osborn illustrated typical induction heating applications, and discussed at some length the contour hardening of gears and the necessity of higher frequencies for true contour hardening, with the design and pitch of the gear teeth playing an important part. He emphasized the fact that the amount of power introduced into the gear teeth is far more important than frequency. Only by having enough power to heat rapidly can we hold the depth of heating shallow and thereby gain the advantage of the higher frequencies.

In the second presentation, H. J. Babcock of Ajax Electric Co. discussed "Trends in Salt Bath Heat Treatment". The manufacturers of various types of salts have standardized on their products and salt furnaces are being manufactured accordingly. Salt baths and furnaces eliminate the atmosphere problem, and since the parts being treated are heated by conduction and not radiation, much faster heating is obtained than in conventional furnaces.

Salt baths are used as a quenching medium for austempering and martempering applications as well as for carburizing, cyaniding and neutral heating purposes.

Much work is being done on continuous salt furnace applications and large installations have been made. Mr. Babcock illustrated with slides some of the newer types of salt baths and also the principles of heating using electrodes immersed in the salt.

W. F. Craig, Jr., of Armour Research Foundation presented the third portion of the panel on "Hardenability Control in Steels". In the past it has been customary to specify alloy steels according to chemical composition limits, and to secure more uniform response in heat treatment, the general tendency has been to restrict chemical composition working ranges for each individual element. This has resulted in the present close composition ranges for standard alloy steels.

The shortcomings of this system were illustrated by Mr. Craig with slides of a typical intermediate hardenability grade, A-8740. Contribution to Jominy hardenability band width caused by variation in each element was indicated.

The effect of each element alone is not large, but when all of the individual effects are added together the possible variation in hardenability of heats strictly within the standard chemical limits is quite wide. A typical part, for example, could vary in quenched hardness at the center of the section from a low of C-27 to a maximum of C-53.

Since the standard chemical grades do not give the desired uniformity, Mr. Craig discussed means by which greater uniformity might be obtained. A review of openhearth melting records indicated that further narrowing of present chemical ranges would not be a practical solution, for industry records show that 15 to 16% of heats melt outside the ranges as now published. Greater uniformity by increasing rejections would be too costly.

What was needed, the speaker pointed out, was simply a change in viewpoint. By abandoning preconceived ideas about composition limits, hardenability could form the basis for alloy steel specifications. In buying steels to hardenability limits (H-steels) with the mills rejecting about the same percentage of heats for "off hardenability" as formerly rejected for "off analysis", more uniform behavior in heat treating is assured.

Heats rejected under this system are those which would give trouble in heat treatment whether within or outside the former standard analysis limits. By widening the composition limits, heats of proper hardenability are used though the analysis might not conform exactly to the former ranges. These heats offset those of satisfactory analysis which are rejected from a hardenability standpoint. Since total rejections are about the same, greater uniformity in response to heat treatment is achieved at no increase in cost to the user.

See page 61 for Metal Congress Hotel Reservation Form

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Professor Describes Atomic Research

Frank G. Foote (Center), Professor at Columbia University School of Mines, Was the Speaker at the May 10th Meeting of the New York Chapter A. S. M. At left (facing the photograph) is Douglas E. Boyd of Joseph T. Ryerson & Son, Inc., chapter chairman, and at right, Thomas W. Lippert, editor of Iron Age, *and technical chairman for the meeting. Speaking on "Some Material Problems Encountered in Atomic Research", Professor Foote gave a general review of the fundamentals of nuclear reactions, followed by specific examples of metallurgical problems which were encountered and had to be solved in order to make possible the successful operation of these reactions on a large scale. (Reported by Birger L. Johnson, Jr.)*

A. W. Gregg. *Foundry,* v. 26, June 1948, p. 86-90.
Results obtained at Armour Research Foundation.

14b-77. A Review of Progress in Gray Iron. Jack H. Schaum. *Foundry,* v. 26, June 1948, p. 98-101, 240-242, 244, 246, 248, 250.
Solidification characteristics; effects of alloying elements; microstructure; sand. 29 ref.

14b-78. Canadian Steel Foundry Practice. S. L. Gertsman. *Canadian Metals & Metallurgical Industries,* v. 11, May 1948, p. 22-26, 40-41.
Trend of developments. 12 ref.

14b-79. The Constant-Charge System of Cupola Operation. W. W. Braidwood. *Foundry Trade Journal,* v. 84, May 6, 1948, p. 435-439; May 13, 1948, p. 465-468.
System for modification of base cupola metal by spout additions to suit a range of castings.

14b-80. Centrifugal and Precision Steel Castings for Aircraft. J. F. B. Jackson. *Engineering,* v. 165, May 21, 1948, p. 481-484.
Application to manufacture of asymmetrical parts.

14c—Nonferrous

14c-35. Effect of Injection Velocity on the Thermal Balance of Die Casting Dies. H. K. Barton. *Machinery* (London), v. 72, April 29, 1948, p. 544-548.
Theoretical calculations and curves of injection pressure vs. injection velocity for six common die-casting alloys.

14c-36. Rapid Die Casting Operation. Albert Greaves. *Modern Metals,* v. 4, May 1948, p. 17-19.
Equipment and procedures.

14c-37. Ingot Metal vs. Virgin Metal. Fred L. Wolf. *American Foundryman,* v. 13, May 1948, p. 94-96.
Commercial-scale tests using three types of furnaces to determine the relative advantages and disadvantages of use of each raw material in the brass foundry. Ingot metal was found to have many advantages. (Presented at 52nd Annual Meeting, A.F.A., Philadelphia, May 3-7, 1948.)

14c-38. Die Casting—An Important Factor in the Production of Hoover Vacuum Cleaners. R. J. Reel. *Modern Industrial Press,* v. 10, May 1948, p. 6, 8, 42, 54-55.

14c-39. Casting Lead Parts in Permanent Molds. Herbert Chase. *Iron Age,* v. 161, May 20, 1948, p. 90-91.
Permanent molds, the semi-automatic casting machines, and the techniques used for production of battery castings weighing up to 23 lb. Sb-Pb alloys used for different parts.

14c-40. Foundry Control Test for Melting High-Zinc Bronzes and Brasses. Joseph A. Duma. *Journal of the American Society of Naval Engineers,* v. 60, May 1948, p. 163-168.
Test which consists of a correlation between specific gravity and tensile strength and elongation. Tables of results of such control tests on manganese, bronze, Naval brass, and commercial brass.

14c-41. Die-Casting Dies; Testing to Determine Production Ability. W. M. Halliday. *Metal Industry,* v. 72, May 1948, p. 398-399, 407; May 21, 1948, p. 419-422.
Recommended procedure.

14d—Light Metals

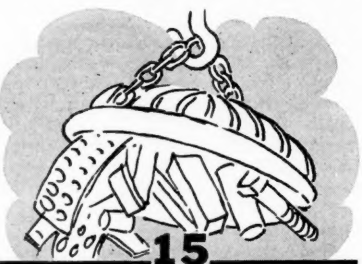
14d-35. Pressure Molding Aluminum-Base Alloy Castings. J. L. Erickson. *Metal Industry,* v. 72, May 7, 1948, p. 385-387.
Abstracted from *Steel,* v. 122, May 3, 1948, p. 98-100. See item 14d-34, 1948.

14d-36. Moderna Tecnica della Colata in Conchiglia delle Leghe di Aluminio e di Magnesio. (Modern Technique for Chill Casting of Aluminum-Magnesium Alloys.) B. Guastalla. *Alluminio,* v. 17, Jan.-Feb. 1948, p. 7-33.
Various methods used and several improvements in mold manufacture in order to minimize defects in the castings. 66 ref.

14d-37. Die-Casting Progress; Part 4. Pressure Die-Casting of Magnesium Alloys. A. C. Street. *Metallurgia,* v. 38, May 1948, p. 3-5.
Recent developments.

14d-38. Aluminum Alloy Castings. Floyd A. Lewis. *Foundry,* v. 26, June 1948, p. 96-97, 262, 264, 266, 268, 270.
Considerations in the design of aluminum-alloy castings. Seventh of a series of articles based on a survey sponsored by the Aluminum Association's Foundry Division.

For additional annotations indexed in other sections, see:
2a-8; 16a-50.



15 SCRAP and BYPRODUCT UTILIZATION

15a—General

15a-7. Salvaging Drilled Parts by Welding. *Machinery* (London), v. 72, May 20, 1948, p. 623.
Jig used with an electric welding machine to salvage dies or other drilled parts.

15a-8. Scrap, Properly Handled, Brings a Premium. C. W. Cederberg. *American Machinist,* v. 92, June 3, 1948, p. 98.
How it is done at Larson Tool & Stamping Co.

15b—Ferrous

15b-29. Recommended Practices for Salvaging Automotive Gray Iron Castings by Welding; A Committee Report. *Welding Journal,* v. 27, May 1948, p. 351-358.
Published for the purpose of securing comments, criticisms, and suggestions.

15b-30. Le Relevement des Ponts et Leur Réparation par Soudure. (Restoration of Bridges and Their Repair by Welding.) A. Goelzer. *Soudure et Techniques Connexes,* v. 2, March-April 1948, p. 70-81, 84.
Methods used on bridges wrecked by bombing.

15b-31. Réparation d'un Arbre de Compresseur de 7000 m³/heure. (Repair of a Compressor Shaft of 7000 Cm. per Hr. Capacity.) G. Gronier. *Soudure et Techniques Connexes,* v. 2, March-April 1948, p. 82-84.
Repair by electric welding. Besides the shaft, the bearing and its support were also fractured.

15b-32. Some Aspects of Welding Repairs. J. K. Johannesen. *Transactions of the Institute of Welding,* v. 2, April 1948, p. 66-74.
Present trends in the application of welding to repairs. Applications of welding to modern mining practice, steam plant, marine and submarine spheres, variables in deposits and base materials, and electrode specialization.

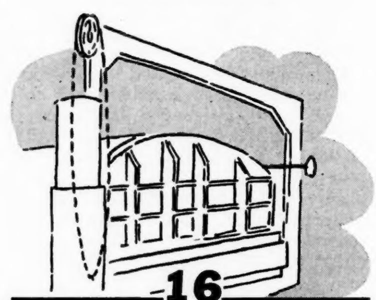
15b-33. Welding Saves Costly Pump Casings. Carl Balow. *Power,* v. 92, June 1948, p. 74-77.
Shock from rapid load changes in 1600-psi. boiler feed pumps called for inner casing made of chromium steel, an alloy difficult to cast without flaws. Careful casting procedure and welding licked the leak problem.

15b-34. Reclaiming Large Iron Cast Parts. E. Barber. *Machinery Lloyd* (Overseas Edition), v. 20, May 22, 1948, p. 101-103.
Various methods, including welding, brazing, metal spraying, and by use of anchor studs. Examples of successful repairs.

15b-35. For More Efficient Production Check Your Maintenance Welding. This Is How It's Done at Caterpillar Tractor Co. A. A. Wald. *Industry and Welding,* v. 21, June 1948, p. 26-29, 46, 48, 50, 52.

15b-36. Scrapping Big Guns. *Welding Engineer,* v. 33, June 1948, p. 34-35.
Use of flame cutting on gun barrels with walls up to 18-in. thick.

For additional annotations indexed in other sections, see:
8-137; 22b-186.



16 FURNACES and HEATING DEVICES

16a—General

16a-49. Preheating of Fuel in Shaft Furnaces and Gas Generators. (In Russian.) B. V. Kantorovich. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences), Jan. 1948, p. 43-52.
Process was investigated theoretically. Equations are derived for determination of the values involved. 10 ref.

16a-50. Large Conveyerized Core Ovens Feature Ford Foundry Rehabilitation Program: Part II (Concluded.) *Industrial Heating,* v. 15, May 1948, p. 829-830, 832, 834, 836.
Vertical ovens, a tractor-part core-baking oven, general equipment for baking molds and cores, and other foundry improvements.

16a-51. Industrial Infrared Heating by Gas. A. G. F. Macadam. *Gas Journal,* v. 254, May 5, 1948, p. 272, 275-276, 281.
Miscellaneous applications and equipment—for paint drying, for drying ceramic ware, for drying vitreous enamel, and in the printing industry.

16a-52. Some Recent Heat Treatment Furnace Installations. *Metallurgia,* v. 38, May 1948, p. 50-57.

(*Turn to page* 32)

Sauveur Memorial Room Dedication Set for Aug. 19

Dedication of the Sauveur Memorial Room at the national office of the American Society for Metals is scheduled for August 19 in Cleveland. The dedication ceremonies will be attended by the national officers and trustees of the society, by Mrs. Sauveur, widow of Albert Sauveur to whom the museum is dedicated, and by any members of the American Society for Metals who would like to attend. They will take place at 3:00 p.m., and will be followed by an informal tea.

The idea of a Sauveur Memorial Room was conceived in 1939 shortly after the famed professor's death, and a committee was appointed to work out the details and collect funds. H. H. Lester of Watertown Arsenal was chairman of the committee, and much of the work was carried out by members of the Boston Chapter, of which Dr. Sauveur had been a leading member.

Nearly $3500 was collected by this committee before plans were interrupted by the war. It is only in the last few months that the society has been able to proceed with the architectural changes and redecoration of the headquarters room set aside for that purpose. With the cost of such construction work at least doubled since the original estimates were made, it has been necessary for the society to appropriate an additional sum from the national budget. The room, which occupies a space 40 x 15 ft., has been redecorated in a suitable color scheme and equipped with built-in glass-enclosed cases properly lighted for display purposes.

Dominating the room will be a fine oil painting of Professor Sauveur executed by Alexander Smith, outstanding portrait artist. Professor Sauveur's desk and chair, his medals, awards and other memorabilia will be displayed as well as some items of historical interest not connected with Professor Sauveur. In the latter category are an early Rockwell hardness testing machine, a complete set of the writings of the late Dr. John A. Mathews, and many photographs and letters of other honorary members and winners of the Sauveur Achievement Award. It is hoped that other museum pieces can be added to the collection as time goes on.

In addition to being a monument to past metallurgical achievement, the room will serve a practical purpose by providing a dignified yet cheerful meeting place for A.S.M. national committees and other conference groups.

Members of the Sauveur Memorial Committee in addition to Dr. Lester were G. B. Waterhouse of Massachusetts Institute of Technology; V. N. Krivobok, International Nickel Co.; Joseph Winlock, Edward G. Budd Mfg. Co.; James P. Gill, Vanadium-Alloys Steel Co.; Bradley Stoughton, Lehigh University; and A.S.M. National Secretary W. H. Eisenman.

Washington Leaders and National Officers

National President F. B. Foley Spoke Before the Washington Chapter A. S. M. on May 10 on "Behavior of Metals Under Stress at Elevated Temperatures". In the photograph are (left to right): Herbert M. Frazier, newly elected chairman of the chapter; National Secretary Bill Eisenman; Wilbur A. Mace, retiring chairman; and President Foley. (Reported by Melvin R. Meyerson)

Heat Treating Fundamentals Interpreted on S-Curve For 18-4-1 High Speed Steel

Reported by John F. Collins
O'Brien Fellow in Metallurgy
University of Notre Dame

The fundamentals of heat treating as interpreted on an S-curve for 18-4-1 high speed steel constituted the springboard from which Morris Cohen began his talk entitled "Inside High Speed Steel". Dr. Cohen, who is professor of physical metallurgy, Massachusetts Institute of Technology, addressed the final meeting of the Notre Dame Chapter A. S. M. on May 12.

If the steel is cooled from the usual austenitizing temperature of 2350° F., Dr. Cohen explained, the austenite may transform to carbide and pearlite in the range of 1400 to 1200° F., providing, of course, that the steel is held at these temperatures for a sufficient period of time. However, if the cooling rate is too rapid for the austenite to transform in this range — that is, if the steel is cooled past 1400° within a few minutes—the transformation may occur partially in the range of 700 to 400°, if it is held there long enough. The product formed in this temperature range is bainite.

A rapid quench from the austenitizing temperature will suppress the formation of both bainite and pearlite, and at 450° martensite starts to form in this 18-4-1 high speed steel. The martensite reaction cannot be suppressed regardless of the velocity of the cooling.

The need for tempering is imperative, since the hardening process leaves the steel in a brittle, highly stressed and dimensionally unstable condition—a condition that renders the steel of little value for most applications. Commercial tempering involves the decomposition of the brittle tetragonal martensite produced on quenching and the partial relief of internal stresses.

In high-alloy toolsteels the retained austenite does not transform to any appreciable extent while at the tempering temperature (900 to 1100°), but rather on cooling therefrom; the resulting product is martensite. In such steels double tempering is advantageous, for it relieves the stresses and toughens the martensite formed during cooling from the first draw. Occasionally the austenite is very sluggish, and two tempers may be needed to convert it. A third temper is then in order for stress relieving and toughening purposes.

Dr. Cohen concluded his address with a few pertinent remarks on dimensional stability, the details of which will be published shortly.

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See page 61

16a-53. The Melting of Small Charges of Finely Divided Metals in Vacuo in Medium Frequency Induction Furnaces. E. A. Brandes. *Research,* v. 1, May 1948, p. 382-383.

The interposition of a graphite or molybdenum sleeve within the vacuum between the crucible and the coil to give increased heat input to the charge is fairly well known. There are, however, objections to the use of graphite in vacuum furnaces for certain melting operations. A simple method for the construction of sleeves from molybdenum wire.

16a-54. Radiative and Convective Heat Transfer Rates Pertaining to Heating Processes; a Theoretical Comparison. Jack Huebler. *Industrial and Engineering Chemistry,* v. 40, June 1948, p. 1094-1098.

16a-55. The Practical Economics of Radio Frequency Heating. B. T. P. Kinn. *Iron Age,* v. 161, June 10, 1948, p. 72-79.

A simple, quick method of determining the economic feasibility of radio frequency heating or dielectric heating by means of some simple arithmetical calculations and a series of check charts.

16b—Ferrous

16b-48. Multiple Fuel Burners for Openhearth Furnaces. J. M. Brashear. *Iron and Steel Engineer,* v. 25, May 1948, p. 60-66; discussion, p. 66-68.

Design details and combustion data. (Presented at A.I.S.E. Annual Convention, Pittsburgh, Sept. 25, 1947.)

16b-49. Recuperation Improves Furnace Efficiency and Operation. Frank D. Hazen. *Industrial Heating,* v. 15, May 1948, p. 786, 788, 790, 792, 794, 796.

Advantages, design drawings and performance charts for steelmaking and processing furnaces.

16b-50. L'Usine a Fonte et le Four Electrique de Choindez, Jura, Suisse. (The Choindez Steel-Melting Plant and Electric Furnace, Jura, Switzerland). *Revue de Métallurgie,* v. 44, Sept.-Oct. 1947, p. 307-318.

Introduction, by H. Fehlmann; History, M. von Anacker; The Choindez Electric, Steel-Melting Plant, by E. Gehring; and Future Prospects for Electric Melting of Iron, by R. Durrer.

16b-51. Portable Cover Sheet Annealing Furnaces. L. G. A. Leonard. *Mettallurgia,* v. 38, May 1948, p. 43-46.

A recent installation for the treatment of silicon-steel sheets for electrical parts.

16b-52. Presidential Address; The Development of the Openhearth Furnace. Andrew McCance. *Iron and Steel,* v. 21. May 13, 1948, p. 198-200, 257.

Mainly historical.

16b-53. Openhearth Furnaces; Construction and Repair Program at Consett. D. C. Muir. *Iron and Steel,* v. 21, May 13, 1948, p. 201-204; discussion p. 263-266.

Previously abstracted from *Journal of the Iron and Steel Institute,* v. 157, Dec. 1947, p. 481-491. See item 16b-7, 1948.

16b-54. Openhearth Gas Ports; Design in Relation to Efficiency. M. P. Newby. *Iron and Steel,* v. 21, May 13 1948, p. 205-207; discussion, p. 263-266.

Previously abstracted from *Journal of the Iron and Steel Institute,* v. 157, Dec. 1947, p. 601-608. See item 16b-8, 1948.

16b-55. Steel-Mill Boilers Designed for Blast-Furnace Gas. W. M. Cline, Jr. *Power,* v. 92, June 1948, p. 84-85, 140.

16b-56. Fonctionnement des Régénerateurs et Cowpers en Accumulateurs de Chaleur. (Operation of Regenerators and Cowper's Stoves as Heat Accumulators.) **Jean Szczeniowski.** *Revue de Métallurgie,* v. 44, Nov.-Dec. 1947, p. 321-329.

After thorough experimental and theoretical investigation, it was concluded that such equipment in its present form is outmoded. This conclusion is based on new techniques using oxygen-enriched air not requiring preheating or a combustion turbine.

16b-57. Some Gas Applications in Steel Mills. H. H. Feirabend. *Industrial Gas,* v. 26, May 1948, p. 8-9, 20-21.

Applications to such operations as continuous bright gas normalizing of strip steel, continuous bright gas annealing of strip steel, one-way-fired soaking pits, atmosphere annealing covers, gas carbon restoration, gas quenching, gas pickling and continuous high-temperature (2500°) roller-hearth furnaces.

16b-58. Presidential Address; the Development of the Openhearth Furnace. Andrew McCance. *Journal of the Iron and Steel Institute,* v. 159, May 1948, p. 1-10.

Mainly historical.

16b-59. Iron and Steel Institute Presidential Address: the Development of the Openhearth Furnace. Andrew McCance. *British Steelmaker,* v. 14, June 1948, p. 263-271.

Mainly historical.

16c—Nonferrous

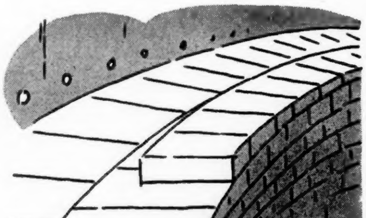
16c-3. Use of Coal in Zinc Production. W. M. Peirce. *Mining and Metallurgy,* v. 29, May 1948, p. 286-288.

Coal and coke consumption in the production of metallic zinc, zinc oxide, and in concentration of certain low-grade ores. Processes, furnaces, and retorts used in these operations. Application of natural gas, producer gas, and the qualifications of coals for the various processes. (Presented at annual meeting, A.I.M.E., Feb. 18, 1948.)

16c-4. Reverberatory Melting of Zinc Base Die-Casting Alloys. R. L. Wilcox. *Iron Age,* v. 161, June 10, 1948, p. 80-82.

Use of 18-ton gas-fired furnace which is reported to effect a reduction of 35 to 40% in direct labor and fuel costs, as compared with pot-type units. Oxidation losses are said to range from 0.5 to 1%.

For additional annotations indexed in other sections, see: 2b-112; 14a-103-110



17 REFRACTORIES and FURNACE MATERIALS

17-50. Ceramics, Refractories, and Cements, S. W. Ratcliffe. *Reports of the Progress of Applied Chemistry,* v. 31, 1946, p. 253-270.

A review. 95 ref.

17-51. The Changes Occurring in Blast-Furnace Stove Refractories During Service. F. Mackenzie. *Refractories Journal,* v. 24, April 1948, p. 115-123.

A condensation.

17-52. The Development of Refractories for High-Temperature Industrial Processes. (Concluded.) A. Hilliard and J. H. McKee. *Refractories Journal* v. 24, April 1948, p. 134-138.

Previously abstracted from *British Coal Utilisation Research Association Monthly Bulletin,* v. 11, Nov. 1947, p. 457-468. See item 17-8, 1948.

17-53. The Manufacture of Refractories and Information Concerning Their Use in the Iron and Steel Industry of Western Germany. (Continued.) *Refractories Journal,* v. 24, April 1948, p. 151-153. Reprinted from F.I.A.T. Final Report No. 432.

(To be continued.)

17-54. Modern Refractories for Openhearth Furnace Bottoms Highly Resistant to Hydration. *Industrial Heating,* v. 15, May 1948, p. 842, 844, 846.

Considerable progress has been made in the manufacture of refractories that resist slaking during long shutdown periods and in improvement of bonding qualities and in freedom from disintegration and hydration.

17-55. Refractory Properties of Domestic Sillimanite. *Industrial Heating,* v. 15, May 1948, p. 848. Based on paper by T. N. McVay, W. A. Hull, and Hewitt Wilson, presented at 49th Annual Meeting, American Ceramic Society, Atlantic City.

Refractory properties of beneficiated schists from South Carolina and Georgia which formed concentrates containing 90% or more sillimanite.

17-56. Recommandations Relatives a l'Emploi des Creusets dans les Fours de Fusion des Bronze et des Laitons. (Recommendations Concerning the Use of Crucibles in Bronze and Brass Melting Furnaces.) Georges Blanc and Pierre Nicolas. *Fonderie,* Jan. 1948, p. 1022-1029.

Methods for manufacture of crucibles and for recovery of the crucible materials.

17-57. I Materiali Refrattari per il Rivestimento Degli Alti Forni. (Refractory Materials for Lining of Blast Furnaces.) Luigi Pompei. *La Metallurgia Italiana,* v. 39, Nov.-Dec. 1947, p. 281-284.

Chemical compositions, thermal and mechanical resistances, and applications of different types.

17-58. An Examination of Blast-Furnace Scaffolds and Scaffold-Forming Materials. J. H. Chesters, I. M. D. Halliday, and J. Mackenzie. *Journal of the Iron and Steel Institute,* v. 159, May 1948, p. 23-36.

Results of a preliminary examination of the materials deposited on the internal surfaces of blast-furnace stacks. Trial of carbon bricks to reduce scaffolding is recommended.

17-59. Factors in Service Behavior of Silica Brick. L. A. Smith. *Blast Furnace and Steel Plant,* v. 36, June 1948, p. 701-706.

Factors related to raw materials, manufacturing processes, and other aspects of brick as such; factors having to do with furnace designs, bricklaying practices and mortars used, and factors incident to service use.

17-60. Armco Relines Blast Furnace in 33 Days. *Iron Age,* v. 161, June 10, 1948, p. 94.

Bricks of fused alumina and zirconia were used in place of the usual steel stock line.

(Turn to page 34)

Kahn-Imbembo Tear Test Evaluates Ductile to Cleavage Failure in Ship Plate

Reported by J. J. Preisler
Sperry Gyroscope Co.

The spectacular and much publicized ship failures which occurred in hull structures of welded steel merchant vessels during the war stimulated extensive investigation of ductile and brittle behavior of ship plate. An important result of one such investigation, carried on by Noah A. Kahn and Emil A. Imbembo of the New York Naval Shipyard, was the development of the tear test for evaluating the transition from ductile to cleavage failure.

In a talk delivered before the New York Chapter A.S.M. on Marh 8, Messrs. Kahn and Imbembo described the background of the problem and the work which led to their presentation of this new tear test method.

The incidence of merchant ship casualties due to failure of ship plate reached a peak in March, 1944, at which time the total casualties equaled 5% of all vessels in operation. Many of the failures occurred with explosive suddenness and apparently without initial yielding. The fractures exhibited no neckdown area, which indicated almost complete lack of ductility, and the fracture surfaces appeared crystalline and showed the chevron or herringbone markings characteristic of brittle or "cleavage" fracture.

It was first thought that the failures were largely caused by improper welding procedure and the presence of locked-up welding stresses. However, an investigation board appointed by the Secretary of the Navy concluded that the fractures in the welded ships were caused by notches, either through design or as a result of workmanship, and by steel which was notch-sensitive at the operating temperatures.

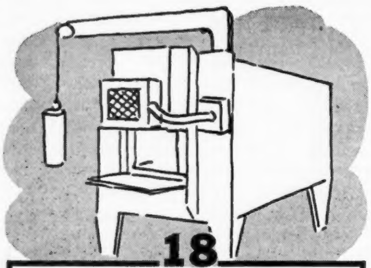
Ship plate from several mills tested by the conventional Charpy impact test revealed wide differences in transition zones, but there was poor correlation between the Charpy transition temperatures and the results of tests on simulated ship structures, such as full-scale hatch corner tests and 72-in. wide plate tests.

Since testing of 72-in. ship plate is not commercially feasible for routine inspection, efforts were directed at developing a laboratory method which would be capable of predicting service conditions under which ship plate would tend to fail with a predominantly cleavage type of fracture.

The test method finally adopted utilizes a simply prepared 3 x 5-in. specimen of full plate thickness, flame cut from the plate. The keyhole notch is a 1/16-in. saw cut terminating in a No. 47 drill hole cut midway in one of the longer edges of the specimen. The specimen is supported on pins mounted in shackles and subjected to static asymmetrical tensile loading. During loading, the specimen is completely submerged in a liquid bath for temperature control.

An automatic load-extension diagram is obtained for each specimen to the point of complete failure. The area of this diagram represents the total energy input to fracture the specimen. This area may be considered as made up of two parts. The first part (up to the maximum load point) represents the energy required to induce initial cracking or tearing; the second part (past the maximum load point) represents the energy required to propagate the tear or crack from start to completion. Cleavage or brittle fracture is evidenced by little or no area in the second part of the diagram.

The fractured specimen offers a large fracture area which may be visually examined, and readily serves as a criterion of ductile or cleavage fracture in the absence of a load-extension diagram.



HEAT TREATMENT

18a—General

18a-11. Salts for Heat Treatment. Ernest Hague. *Metallurgia,* v. 38, May 1948, p. 39-43.

18a-12. Instruments Aid Metallurgical Research at Mack Mfg. Corp. *Instrumentation,* v. 3, Second Quarter, 1948, p. 12-14.

Heat treating aspects which use control instruments.

18a-13. Heat Transfer in a Recirculating Furnace. M. J. Sinnott and C. A. Siebert. *Industrial and Engineering Chemistry,* v. 40, June 1948, p. 1039-1044.

The heating of steel from room temperature to 600, 800, 1000, and 1200° F. was studied and the effect of air temperature and air velocity on the rate of heat transfer was investigated.

18a-14. Modern Heat Treating; A Reference Index. F. R. Morral. *Iron Age,* v. 161, June 10, 1948, p. 83-85.

105 references are listed and indexed.

18b—Ferrous

18b-74. Some Peculiarities in the Behavior of Steel During Rapid Heating by Means of High-Frequency Electric Current. (In Russian.) M. G. Lozinskii. *Izvestiya Akademii Nauk SSSR., Otdelenie Tekhnicheskikh Nauk.* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences), Jan. 1948, p. 109-130.

Three types of structural steels were investigated. The zone of hardening was found to increase sharply in size with decrease in the duration of the heating cycle and correspondingly increased with higher rate of heating. The data, which are charted and illustrated, indicate the effects of various alloying elements on displacement and size of the hardened zone. 18 ref.

18b-75. Direct Quenching; Experimental Practice at Ruhrstahl A. G. Witten. *Iron and Steel,* v. 21, May 1948, p. 181-182. Based on B.I.O.S. Miscellaneous Report No. 58.

Quenching billet and bars direct from rolling on a production basis in German plant.

18b-76. Gray Cast Iron; Some Principles Involved in Heat Treatment. Alfred Boyles. *American Foundryman,* v. 13, May 1948, p. 97-106.

Fundamental principles involved in the heat treatment of cast iron. Certain basic differences between this material and steel as regards transformation behavior during heating and cooling.

18b-77. Induction Hardening Expedites Production of Axle Shafts. Guy O. Hunt. *Industrial Heating,* v. 15, May 1948, p. 758, 760, 762.

18b-78. Heating and Heat Treating Operations in Production of Timken Railroad Bearings. *Industrial Heating,* v. 15, May 1948, p. 772, 774, 776, 778, 780, 782.

18b-79. New Technique Facilitates Brazing Stainless Steel. *Industrial Heating,* v. 15, May 1948, p. 784.

New process utilizes a hydrogen atmosphere more pure than any previously used.

18b-80. Precision Heat Treating Performed at Rochester Division of Lindberg Steel Treating Co. *Industrial Heating,* v. 15, May 1948, p. 856, 858, 860, 862.

(To be continued.)

18b-81. Heat Processing Easily Oxidized Metals. F. C. Kelley. *Iron Age,* v. 161, May 20, 1948, p. 84-89.

A technique for purifying and applying hydrogen atmosphere for furnace brazing, bright annealing, and sintering of high-Cr irons, Ni-Cr alloys and 18-8, including construction of several laboratory and commercial units. Assemblies that can be satisfactorily processed in this way.

18b-82. Heat Treating Special Trackwork at Bethlehem's Steelton Plant. *Railway Age,* v. 124, May 22, 1948, p. 40-41.

18b-83. Investigation by the Thermoelectric Method of Several Processes Which Take Place in Alloys. Part I. (In Russian.) Yu. M. Margolin. *Zhurnal Teknicheskoi Fiziki* (Journal of Technical Physics), v. 18, Jan. 1948, p. 61-70.

Tests were made to establish the value of the electromotive force method for the study of alloy solubility during heat treatment. 33 ref.

18b-84. Formation of Cracks in Steel During the Martensite Transformation. (In Russian.) E. S. Yakovleva and M. V. Yakutovich. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 18, Jan. 1948, p. 71-74.

All cases of formation of cracks during tempering can be explained by one of two schemes. Artificial crack formation according to one of the schemes was produced in small specimens of different carbon contents.

18b-85. Transformation During Heating With High-Frequency Currents. (In Russian.) I. N. Kidin. *Zhurnal Tekhnicheskoi Fiziki* (Journal of Technical Physics), v. 18, Jan. 1948, p. 75-84.

Phase transformations of steel during thermoelectric treatment. It was found that the characteristic feature of the transformation was the specific action of the current on the ferrocementite mixture and consolidation of the lines of force at the phase boundary, resulting in quicker formation of austenite nuclei than in other methods of heat treatment.

18b-86. Gas Carburizing With Town's Gas. D. S. Laidler. *Metallurgia,* v. 38, May 1948, p. 46-49.

The application of theories of diffusion of carbon into iron and steel has been studied over a long period in efforts to develop methods of carburizing which permit complete control. 13 ref.

18b-87. Gas Cyaniding Small Parts. H. N. Ipsen. *Iron Age,* v. 161, May 27, 1948, p. 84-87.

Use of a batch-loading, continuous-unloading, gas, cyaniding furnace, particularly adapted to cyaniding small thin-sectioned parts. Economic advantages of this process.

18b-88. "Submarine" Quench Technique Employed in Forming and Hardening Auto Leaf Springs. Gerald Eldridge Stedman. *Steel,* v. 122, June 7, 1948, p. 92-94.

Work is clamped to forming die on each of nine stations or "paddles" of wheel-shaped revolving unit and immediately quenched before tempering. A modified version of the single-operation process is also used for bumper treatment.

18b-89. Heat Treatment of Precision Bearings at S.K.F. A. L. Neudoerffer. *Instrumentation,* v. 3, Second Quarter, 1948, p. 3-5.

Procedures for ball and roller bearings.

18b-90. The Annealing of Cast Iron in Hydrogen. J. Bernstein. *Journal of the Iron and Steel Institute,* v. 159, May 1948, p. 11-15.

The decarburization of cast iron in dry and moist hydrogen atmospheres, and experiments in which white cast irons were annealed in carefully dried hydrogen. 10 ref.

18b-91. Flame Hardening—Principles, Applications, and Equipment. Merrill S. Rosengren. *Welding Journal,* v. 27, June 1948, p. 453-455.

18b-92. Heat Treating Special Trackwork at the Mill. *Railway Engineering and Maintenance,* v. 44, June 1948, p. 596-597.

Equipment by means of which crossings, frogs, and switches may be subjected to carefully-controlled heat treatment in order to increase resistance to wear.

18b-93. Quenching Steel in Molten Media. F. R. Morral. *Steel,* v. 122, June 21, 1948, p. 92-95, 116.

Cooling characteristics and "H" values of various molten quench salts and interpretations of "U" curves for quenched steels. 23 ref.

18d—Light Metals

18d-5. Nature of Hardness and of the Process of "Strengthening" of Metals and Alloys. (In Russian.) S. T. Kishkin and R. L. Petrusevich. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences), Jan. 1948, p. 87-96.

It was found that the hardening of aluminum in the process of aging following tempering depends, not on peculiarities of initial structure, but upon "strengthening" induced by formation of highly displaced particles of a new phase during plastic deformation. These particles block the slip planes in a manner analogous to the action of martensite in steel.

18d-6. Reduction of Quenching Stresses in Wrought Aluminum Alloys. B. W. Mott. *Metal Treatment,* v. 15, Spring 1948, p. 14.

Methods by which a compromise can be effected between the demands for high mechanical properties and for the avoidance of undue quenching stresses.

18d-7. Le Traitement Thermique De Reversion. (Thermal Treatment of "Reversion".) Raymond Chevigny and Robert Syre. *Revue de l'Aluminium,* v. 25, March 1948, p. 93-96.

The term "reversion" refers to the brief ductile period observed in light alloys immediately after quenching. Principal characteristics of this phenomenon and its application to various nonferrous alloys.

For additional annotations indexed in other sections, see:
3d-30; 11-135; 16a-52; 22b-164-172; 27a-83; 27b-32-33.

(*Turn to page* 36)

Seventeen Past Chairmen Honored at Hartford

Seventeen Past Chairmen of the Hartford Chapter A.S.M. Were Honored on May 11 When the Chapter Celebrated National Officers' and Past Chairmen's Night. Seated left to right, are: J. A. Swift, W. H. Eisenman (national secretary), F. B. Foley (national president), D. A. Tullock, Jr. (current chairman), C. T. Hewitt, and F. P. Gilligan (a past president). Standing: J. G. Cerina, W. P. Eddy, Jr., J. H. G. Williams, R. J. Haigis, R. W. Woodward, H. J. Noble, H. J. Fishbeck, E. L. Wood, J. C. Kielman, A. H. d'Arcambal (also a past national president), D. W. Fryback, C. J. Umlauf, O. G. Hogaboom, W. E. Bancroft. (Photo by Howard Barton)

Induction Heating Machine Is Likened to Shop Tool Such as Lathe or Shaper

Reported by J. R. Dobie

Mechanical Engineer, Wickwire Spencer Steel Co.

Bypassing a theoretical exposition of megacycles and electronics, Frank W. Curtis, consulting engineer for Induction Heating Corp., confined his talk on "High-Frequency Hardening and Brazing" to jobs done in the production line. Mr. Curtis addressed the Worcester Chapter A.S.M. on May 9.

The latest machine for induction hardening is another shop tool like a lathe or a shaper, he said. The work required to produce a hardened part is not any more difficult than the work required on these other machines. Such work can be done on a production line without the digression often necessary to heat treat a part by quench-and-draw methods in a separate room.

The speaker candidly admitted that induction hardening is largely used at present for small parts, or partial elements of larger ones. Slides and films depicted the use of this method in nearby plants. Color photographs proved that the parts reach hardening temperature before quenching.

Some of the problems involved in coil design were considered, but Mr. Curtis insisted that only common sense is needed in dealing with any of them. Fully automatic and semi-automatic setups where the human element causing time variations is entirely eliminated were of particular interest. Once a series of settings has been evolved for a satisfactory product, the parts drop into the quench like water from a faucet into a pan.

Mr. Curtis had a small bench-type heating generator on display. He told how a machine has been coupled into a press setup so that as the press pauses in its operation a spot is heated in the continuous strip as it is fed in to bring it to the proper temperature for working in the press.

Prior to the main talk, the members were treated to a cheery hello from National Secretary Bill Eisenman, who gave a brief but clear statement of the national society and its programs.

See page 61 for Metal Congress Hotel Reservations

Erratum—Transactions

An error has been brought to light in the recently issued Volume 40 of A. S. M. *Transactions.* It occurs in the article on "Some Factors Affecting the Induction Hardening of an Alloy Cast Iron" by J. R. Sloan and R. H. Hays. The caption for Fig. A on page 1075 should read as follows: "Fig. A—Tangential Stresses at Center—3000 Cycles per Second Induction Hardened Liner. E = 18.1×10^{6}"

Conducts Lecture Course On Steel Bar Stock

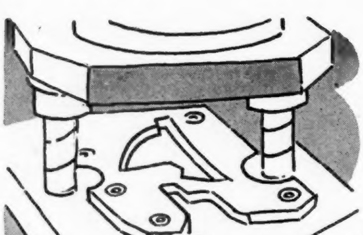
John K. Killmer, metallurgical engineer on the staff of the operating vice-president, Bethlehem Steel Co., presented three lectures during April in the spring educational series of the Golden Gate Chapter A.S.M. in San Francisco. The lecture course covered the application and use of plain, alloy and toolsteel bar stock.

J. K. Kilmer

In the first lecture Mr. Killmer discussed the different types and qualities of carbon bars and their applications.

Turning to alloy steels in the second lecture, he stressed the H-steels and the reasons why they are advantageous to the small consumer. Steels best suited to various special uses were discussed, including low and high-temperature applications. He concluded this talk with a discourse on the selection of a grade of steel for a particular use, taking as an example a heavy-duty automobile axle. No one grade of steel is best, he said; rather, the whole matter is a question of applied metallurgical economics.

Finally, he classified toolsteel bar products into 21 grades, which will do practically every toolsteel job.



19 WORKING

19a—General

19a-104. Influence of Rolling and Forging on the Mechanical Properties of Medium Carbon Steel. (In Russian.) M. V. Rastegaev. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences), Jan. 1948, p. 103-107.

Medium carbon steels used in production of railroad-car axles and connecting rods (0.32% C, 0.68% Mn, 0.26% Si, 0.035% S, and 0.027% P; and deoxidized with 250 g. of Al per ton), were investigated. Mechanical properties of rolled steel are better than those of forged steel after the same heat treatment, and structure of the former is more homogeneous.

19a-105. Get More From Your Press Brake. *Sheet Metal Worker,* v. 39, May 1948, p. 62-63.

First of a series on press-brake operations.

19a-106. Designing of "Trouble-Free" Dies. Part LXXXI. Types of Presses, Their Uses and Capacities. C. W. Hinman. *Modern Industrial Press,* v. 10, May 1948, p. 26.

19a-107. Northrop's Prosthetics Program Revolutionary. Charles Spencer Poe. *Modern Industrial Press,* v. 10, May 1948, p. 48, 50, 52.

Fabrication of prosthetic devices from various metals, alloys, and plastics. Press and machine-shop operations.

19a-108. Sheet and Tin Plate Mills; Measurement of Roll Camber. J. H. Mort. *Iron and Steel,* v. 21, May 1948, p. 147-149.

Description of methods.

19a-109. Internal Stresses in Metals. W. A. Wood and N. Dewsnap. *Nature,* v. 161, May 1, 1948, p. 682-683.

Two types of internal stress may arise in a metal during plastic deformation: first, irregular stresses which may be explained by the Heyn hypothesis of anisotropy and inhomogeneities of granular texture; and second regular internal stress, which is of special interest because it must be associated in a fundamental manner with the response of the metallic lattice to external stress.

19a-110. Internal Stresses in Metals. G. B. Greenough. *Nature,* v. 161, May 1, 1948, p. 683.

Various theories. It is believed that the hypothesis of a complex system of Heyn stresses is adequate.

19a-111. Metal Forming; The Function of the Lubricant During Fabrication. A. H. Stuart. *Metal Industry,* v. 72, May 7, 1948, p. 377-380.

Lubricant requirements. Graphite as an "ideal solid lubricant".

19a-112. Practical Ideas. *American Machinist,* v. 92, May 20, 1948, p. 116-120.

Bar-type reamer cuts smooth bore using hardened circular cutters, by G. R. Milner; winding of brass coil springs using drilled block, lathe, and arbor, by John J. Moffett; discussion of opinions of Edward Rautsch in a recent issue regarding reduction of tool-point widths when a threading job is moved from a lathe to a mill, by Carl A. Johnson; conversion of grinder to form arcs of long radius on bearing caps, by George Werner; use of flushpin gage to check an internal recess in a cylinder, by Glen Shopbell; 13-hook rig for transferring steel bars from furnace to quenching bath; turning rise on cams with templet-and-follower setup, by Burl Mansberger; use of drillpress in sharpening slitting saws, by H. Scala; ball center grips end of stock to permit cutting collars from brass tubing, by Allen B. Nixon; fixture for production bending of lever, by Charles H. Willey; cut-away section on stripper plate speeds hand feeding of strip stock to press, by Arthur F. Hird; fixture for locating blind holes, by L. Kasper; and other miscellaneous shop hints.

19a-113. Pilots for Progressive Dies. *American Machinist,* v. 92, May 20, 1948, p. 127, 129, 131.

Various types.

19a-114. Sheet Leveler Incorporates New Feature. Thomas E. Lloyd. *Iron Age,* v. 161, May 20, 1948, p. 92-94.

A sheet leveler incorporating a solid-platen backup, instead of conventional backup rolls, and an endless-chain roll drive was used during the war for flattening silver chloride. Now used to flatten sheet steel for refrigerator cabinets.

19a-115. Progressive Die Design, Part V. C. W. Hinman. *Modern Machine Shop,* v. 21, June 1948, p. 144-146, 148, 150, 152.

Construction and operation of two dies—one for forming time-fuse escape levers and the other for producing double-edge razor blades.

19a-116. Forming Cookson Lock Joints. J. B. Clegg. *Machinery* (London), v. 72, May 20, 1948, p. 622-623.

The various press-brake operations involved in forming the joint.

19a-117. Strip Rolling. *Metal Industry,* v. 72, May 28, 1948, p. 446-447.

Application of hydraulic variable speed drives to a fully reversing four-high cold-strip rolling mill.

19a-118. Bath Contour Forming, a New Metalworking Process. *Automotive Industries,* v. 98, June 15, 1948, p. 32-33, 67.

New technique for making pieces difficult to produce economically by conventional methods, of both ferrous and nonferrous metals.

19a-119. How Colloidal Graphite Aids Metal Forming. G. C. Giles. *American Machinist,* v. 92, June 17, 1948, p. 143.

Directions for miscellaneous forming and lubrication operations.

19a-120. Practical Problems of Light Presswork Production. (Continued.) J. A. Grainger. *Sheet Metal Industries,* v. 25, June 1948, p. 1145-1152.

Standardization in design by use of standard press charts. (To be continued.)

19a-121. Tooling for Cold Roll-Forming and Auxiliary Operations. E. J. Vanderploeg. *Machinery,* v. 54, June 1948, p. 172-176.

Roll-forming machines can be tooled to emboss, bevel, coil, curve, and to produce multiple sections of two or more materials. (Fourth of a series.)

19a-122. Precision "Stamping" on the Broaching Machine. *Tool Engineer,* v. 20, June 1948, p. 29.

Equipment for production of telephone-relay part.

19a-123. Fundamentals of Forging Practice. Waldemar Naujoks. *Steel,* v. 122, June 7, 1948, p. 100-102, 104, 129; June 21, 1948, p. 98-102.

First part is devoted to historical information. Second installment begins a highly practical discussion of how forgings are made, how best to utilize the established laws of metal flow, forgeability of metals, and the smith-forging method. (To be continued).

19b—Ferrous

19b-68. Trailer Fabrication at Steel Products Company, Inc. Gerald E. Stedman. *Modern Industrial Press,* v. 10, May 1948, p. 38, 40, 42.

Press operations and materials handling.

19b-69. Automatic Equipment Speeds-up Production at Schnefel Brothers. Floyd McKnight. *Modern Industrial Press,* v. 10, May 1948, p. 44, 46.

Press and machine-shop operations in production of a variety of manicure scissors, nippers, tweezers, clips and files.

19b-70. Steel Shapes Formed by Cold Extrusion. Kenneth Rose. *Materials & Methods,* v. 27, May 1948, p. 68-71.

Tubular, cylindrical, and other symmetrical forms can be produced by a process which resembles impact extrusion, except that more steps are required.

19b-71. How Conversion to Other Materials Solved Malleable Castings Shortage. Herbert Chase. *Materials & Methods,* v. 27, May 1948, p. 89-92.

Truck components were converted to forgings or to stampings with savings in cost and weight. Tooling costs were generally higher but were soon offset by lowered piece costs.

19b-72. Wheelbarrows and Garden Implements. *Western Machinery and Steel World,* v. 39, May 1948, p. 74-79.

Forging and welding operations.

19b-73. Modern Universal Slabbing Mills. A. R. Kruse. *United Effort,* v. 28, May 1948, p. 3-5.

19b-74. Compound Die Cuts Off, Forms, Curls. Joseph J. McGuinness. *American Machinist,* v. 92, May 20, 1948, p. 106-107.

Reduces from six to one the number of operations required to manufacture a steel valve part used in an air-control device.

19b-75. Increased Forging Die Life. Herbert Chase. *Iron Age,* v. 161, May 27, 1948, p. 88-94.

Study of die lubrication and other factors causing die deterioration has reduced die steel consumption and scrap losses.

19b-76. Multiple Piercing Dies for Making Motor Laminations. *Machine and Tool Blue Book,* v. 44, June 1948, p. 183-184, 186-187.

By replacing notching dies with multiple-piercing dies in the manufacture of motor laminations, substantial savings in die costs were made. Production was also increased and four punch presses were freed for other jobs.

19b-77. New Self-Contained Line for Making Stabilizer Bars. *Automotive Industries,* v. 98, June 1, 1948, p. 40-41.

Miscellaneous press operations.

19b-78. Unconventional Methods Used to Make U-Flex Piston Rings. *Automotive Industries,* v. 98, June 15, 1948, p. 38-39, 74.

Steps required to produce the above from S.A.E. 1095 steel in coil form by a series of forming operations, followed by heat treating, grinding, burring, and polishing.

19c—Nonferrous

19c-14. The Texture of Copper Wire Drawn With Backpull. J. F. H. Cus-

(*Turn to page 38*)

Work Input Required to Cut Metal Suggested as Criterion of Machinability

Reported by R. M. McBride
Universal Products Co.

Machinability is judged by many standards and affected by many factors, depending on the job at hand, D. A. Nemser told the Detroit Chapter A.S.M. on April 12. Mr. Nemser, who is in charge of the New England technical section of the development and research division, International Nickel Co., spoke on "Effect of Structure on Machining Steels". O. W. McMullan, chief metallurgist, Bower Roller Bearing Co., served as technical chairman of the meeting.

Mr. Nemser suggested that the work input required to cut a metal is perhaps the most useful definition of machinability. The speaker's thesis was that "good" or "bad" machinability is not inherently associated with the chemistry of the steel, but rather with its structure.

Three types of chip formation were described. The first type is obtained from materials absorbing relatively small amounts of energy in flowing before rupture occurs (as in sulphurized steels); a discontinuous chip is formed. The second type forms a continuous chip in a steel of uniform structure and limited ductility. It requires more work than the first type but usually provides a satisfactory finish. The third type piles up ahead of the tool point and absorbs considerable energy in flowing. The finish produced is usually poor.

Ferrite, carbide and insoluble impurities are of fundamental importance. The inclusions act as chip breakers and cannot be altered as to size or distribution after the hot working of the steel has been completed. There is an opportunity, however, to alter the size of the carbide and its distribution in the ferrite matrix. When alloying elements are added to the steel, their basic influence with respect to machinability is relatively unimportant as compared to their effect on the structure developed during treatment.

The distribution of the strong-hard constituent in the weak-ductile matrix will determine the ease of cutting. By producing properly spaced and distributed carbides the ferrite flow may be confined to small areas and the shearing energy reduced. Production experience has shown that medium-carbon steels with lamellar or spheroidized structures cut more easily than low-carbon steels, which contain much larger areas of blocky ferrite.

Steels with moderately high carbon or alloying elements rapidly cooled will contain finely dispersed carbides and will be difficult to cut. Since the work done in cutting depends on the energy absorbed in elastic flow and the energy required to cause rupture, both the strength and ductility properties of the material are involved.

Factors developed in cold drawing that are beneficial from the standpoint of machining are the marked decrease in elongation with but a slight increase in tensile strength. The cold drawing causes plastic flow and consequently energy must be absorbed. When the material is machined, that portion of the energy used in plastic flow has already been provided by cold drawing, and consequently a chip can be formed with less energy input.

Conventional furnace annealing of alloy steels has produced improper structures so that these steels were characterized as having inherently poor machinability. The development of the TTT-curves has provided a guide for producing the most desirable structures in least time. Where one part requires several machining operations, a compromise structure may be necessary favoring the most critical operation.

The speaker concluded that when economically feasible, structures that insure optimum machinability should be designated. In such a state, machinability will be quite independent of chemical composition.

Templin Addresses Purdue Chapter

At the April Meeting of the Purdue Chapter A. S. M. Are (Left to Right): Thomas McCormick of Aluminum Co. of America, Vice-Chairman of the Purdue Chapter; R. L. Templin, Assistant Director of Research for Alcoa, the Speaker at the Meeting; W. C. Winter, Works Manager of the Lafayette Plant of Alcoa; R. G. Sturm of Purdue University, the Coffee Speaker; and Harold Bates of Fairfield Mfg. Co., Chapter Chairman. (Reported by George Sommer)

Toolsteel Failures Due to Heat Treat, Grinding, Design

Reported by W. R. Jackson
Carboloy Div., C. G. E. Co., Ltd.

John R. Harbaugh, metallurgical service engineer of the Jessop Steel Co., presented a timely and practical paper to the members of the Ontario Chapter on April 2 in Toronto. Mr. Harbaugh's subject was "Toolsteels and Toolsteel Failures", and most of the subject material was accumulated in servicing failures due to heat treatment, grinding and design.

In the first part of his address, Mr. Harbaugh stressed the importance of obtaining toolsteels from reliable mills whose methods of melting and working are closely controlled. Mr. Harbaugh showed a number of slides of die failures and explained how such failures could be avoided by proper heat treatment, design and grinding practice.

Mr. Harbaugh was introduced by Harold Chambers of the Atlas Steel Co., the technical chairman.

Speaker Available for Chapters

U. S. Steel Corp. Research Laboratories has announced the availability of a speaker for A. S. M. chapter meetings. He is George V. Smith of the laboratory staff, who has been working widely in the high-temperature field, including oxidation, creep, creep-rupture and graphitization.

See page 61 for Metal Congress Hotel Reservations Make Them Now!

ters. *Physica,* v. 13, Aug. 1947, p. 366-378.

In wire drawn with backpull, the so-called conical fiber texture which predominates developed less intensively than in wire drawn in the normal way. It is, however, still questionable whether properties like tensile strength are improved sufficiently to justify use of backpull.

19d—Light Metals

19d-27. Extrusion and Drawing of Aluminum Alloys. *Metal Treatment,* v. 15, Spring 1948, p. 27-30, 46.

Methods and equipment of a British firm.

19d-28. Detroit Plant Concentrates on Magnesium Manufacture. P. D. Aird. *Modern Industrial Press,* v. 10, May 1948, p. 13-14, 18, 22, 24.

Stamping, forming, bending, of miscellaneous large and small Mg-sheet parts.

19d-29. Hydraulic Colossus. *Applied Hydraulics,* v. 1, May 1948, p. 17-18, 22. Based on article in *Technical Data Digest,* v. 13, no. 4.

Use of a giant hydraulic forging press to produce aircraft light-alloy parts lighter, stronger and to finished limits faster than possible by previous fabricating methods.

19d-30. Stressed Aluminum. E. A. Owen, Y. H. Liu, and D. P. Morris. *Nature,* v. 161, May 1, 1948, p. 681-682.

Results of some investigations on high-purity aluminum, with regard to structural changes taking place during and after application of compressional stress. Differences of behavior of foils made by compressing annealed filings of aluminum in contrast to behavior of bulk aluminum. Effects of foreign atoms, and structures of filed and polished surfaces.

19d-31. Influence of Degree of Deformation on Relationship Between Stress and Rate of Deformation. (In Russian.) L. D. Sokolov. *Zhurnal Teknicheskoi Fiziki.* (Journal of Technical Physics), v. 18, Jan. 1948, p. 93-97.

As a result of experiments on compression of cylindrical specimens of different metals with various rate of deformation, it was found that the "rate coefficient" depends on the degree of deformation. 20 ref.

19d-32. La Deformation a Chaud des Metaux a la Presse et au Marteau-Pilon. II. Les Lois de l'Ecrasement; Applications et Conclusion. (Hot Deformation of Metals by the Stamping Press and Forging Hammer. Part II. Laws of Deformation; Applications and Conclusion.) Marcellin Chartron. *Revue de l'Aluminium,* v. 25, April 1948, p. 113-122.

Investigated for light alloys, primarily on the basis of Tresca's law.

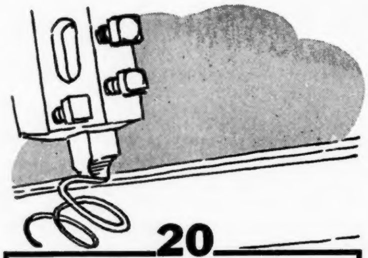
19d-33. Stretch Forming Aluminum Sheets. *Iron Age,* v. 161, June 3, 1948, p. 86-87.

Use of Kirksite dies to form aircraft parts formerly made on drop-hammers.

19d-34. Introduction to Aluminum Presswork. Part I. J. W. Lengbridge. *Tool Engineer,* v. 20, June 1948, p. 17-22.

First of a series on the theory and practice of forming aluminum.

For additional annotations indexed in other sections, see: 18b-88; 20a-246; 27a-83.



20 MACHINING and MACHINABILITY

20a—General

20a-210. Automatic Transfer Machining of Rear Axle Housings. *Machinery* (London), v. 72, April 29, 1948, p. 534.

Method used.

20a-211. Recommendations for Drilling Various Materials. *Machinery* (London), v. 72, April 29, 1948, p. 543.

A table.

20a-212. Modern Machining of Center Holes. *Industrial Diamond Review,* New Series, v. 8, May 1948, p. 152-154.

Special British and Swiss machines.

20a-213. Gearing the West. Ralph G. Paul. *Western Machinery and Steel World,* v. 39, May 1948, p. 70-73.

Production of gears on West Coast.

20a-214. Improved Accuracy of Cam Teeth Surfaces. *Western Machinery and Steel World,* v. 39, May 1948, p. 84.

Manufacture of precision telephone-relay part by broaching after blanking.

20a-215. Berkeley's Univator. *Western Machinery and Steel World,* v. 39, May 1948, p. 88-91.

Production of unique piece of farm machinery designed to do the work of plow, disk and harrow all in one operation.

20a-216. Sharpening and Care of Carbide Milling Cutters. *Western Machinery and Steel World,* v. 39, May, 1943, p. 94-97. Reprinted from "Milling with Carbides", a publication of the Milling Cutter Division of the Metal Cutting Tool Institute.

20a-217. Fixtures for Duplex Surface Grinders. R. D. Gardner. *Machinery* (London), v. 72, April 29, 1948, p. 531-534.

Several types.

20a-218. Centerless Grinding Fountain-Pen Nib Sections. *Machinery* (London), v. 72, May 6, 1948, p. 565.

20a-219. Recent Developments in Crush Dressing Abrasive Wheels. E. C. Luce. *Machine and Tool Blue Book,* v. 44, June 1948, p. 151-156, 158.

Tests proved the practicability of crush dressing and grinding contour forms as wide as 2 in. and approximately 1/8 in. to 3/16 in. in depth. Equipment procedure for these tests.

20a-220. Honing Is Precision Production. *Tool and Die Journal,* v. 14, June 1948, p. 50, 52, 54, 64.

Development of controlled stones; speed of stock removal; production-honing uses; examples of production rates; abrasive engineering progress; stone specification; honing speeds and feed; honing pressure and power; coolants for honing; coolant filtration; the problem of taper in blind holes and its correction; and distortion correction by honing.

20a-221. Machine Tools. A. H. Lloyd. *Institution of Mechanical Engineers, Proceedings,* v. 157, War Emergency Issue No. 32, 1947, p. 295-298.

A discussion of the above in terms of future prospects for design and manufacture which contribute to accuracy, durability, and productivity.

20a-222. Cutting Fluid Developments. J. M. Stewart. *Automobile Engineer,* v. 38, May 1948, p. 183-184.

Characteristics of sulpho-chlorinated oils for machining processes, including applications, health factors, and reclamation.

20a-223. Machining Motor Car Cylinder Heads and Manifolds; Methods Employed in the Production of the New Austin Car. *Machinery,* (London), v. 72, May 13, 1948, p. 587-592.

20a-224. A South African Firm's Adventures in the Field of Munitions Production. Based on paper by H. M. D'Aeth. *Machinery,* (London), v. 72, May 13, 1948, p. 596-599.

Development of special-purpose machine tools for production of 10-lb. practice bombs.

20a-225. New Developments in Honing. Charles H. Wick. *Machinery,* v. 54, June 1948, p. 145-150.

Fundamental principles of the process.

20a-226. Shaft Duplicating in Single-Tool Lathe Operations. *Machinery,* v. 54, June 1948, p. 151-155.

Cylindrical work which can be accurately reproduced at high production rates on lathes equipped with a finish-turned part or templet and a hydraulically-controlled single cutting tool.

20a-227. Design and Application of Carbide-Tipped "All-Depth" Drills. Fred W. Lucht. *Machinery,* v. 54. June 1948, p. 156-160.

Use of drills of this type in obtaining high production rates, higher feeds, and long drill life between grinds. Large holes can be drilled from the solid instead of having to remove material by several successive drilling operations, and deep holes can be drilled without withdrawing drill to clear the chips.

20a-228. Producing Intricate Parts on a Multiple-Purpose Machine Tool. Ira P. Mabie. *Machinery,* v. 54, June 1948, p. 182-184.

Production of castings for package-making machines on a single horizontal boring, drilling, and milling machine. Production is increased and cumulative errors resulting from separate setups are eliminated.

20a-229. Tool Engineering Ideas. *Machinery,* v. 54, June 1948, p. 196-198.

A Simple Setup for Turning Concave Surfaces, by Clifford T. Bower; New Die Frame Design That Saves Labor and Material, by Robert Mawson; Novel Thrust Shoulder for Grinding-Wheel Spindle, by Donald A. Baker.

20a-230. Tooling and Production of the Apex Fold-A-Matic Ironer. Part V. Carl F. Benner. *Tool & Die Journal,* v. 14, June 1948, p. 42-46, 48, 68, 70.

Production of the gear case. Boring shaft holes and bosses; checking centerline dimensions; drilling top-cap-attaching hole; fixture for multi-tapping head; speed-control marker; and tapping universal coupling shaft boss. (To be continued.)

20a-231. Automatic Precision Production to "Tenths" Without Jigs. *Tool & Die Journal,* v. 14, June 1948, p. 56-58, 60.

Construction, operation, and advantages of DeVlieg machine tool known as the "Jigmil".

20a-232. Production Processes—Their Influence on Design. Part XXXIV. Honing and Lapping. Roger W. Bolz.
(Turn to page 40)

Good Formability of Austenitic Stainless Leads to Wide Use

Reported by Knox A. Powell
Research Engineer, Minneapolis-Moline Power Implement Co.

V. N. Krivobok of the development and research division of the International Nickel Co., like the celebrated Dr. Timoshenko under whom he once studied at the St. Petersburg Polytechnic Institute, has the rare faculty of making the most involved problems appear simple and crystal clear. This facility was demonstrated to an enthusiastic audience of Northwest Chapter A.S.M. members when Dr. Krivobok spoke recently on "Factors Governing the Forming of Austenitic Stainless Steels".

The speaker opened his talk by sketching the various types of stainless steel, based upon composition and upon the media which they will withstand. Stainless qualities depend largely on the presence of chromium, and are further enhanced by the addition of nickel in amounts sufficient to produce an austenitic structure as the main constituent.

The facility with which intricate forming operations are performed on austenitic stainless steel is greatly responsible for their greatly widened use in recent years. Dr. Krivobok's investigations indicate that it is erroneous to judge the forming qualities by the standard values for per cent elongation in 2-in. gage length; that is to say, many austenitic stainless steels of the same hardness may show closely identical elongation factors at the immediate point of tensile failure.

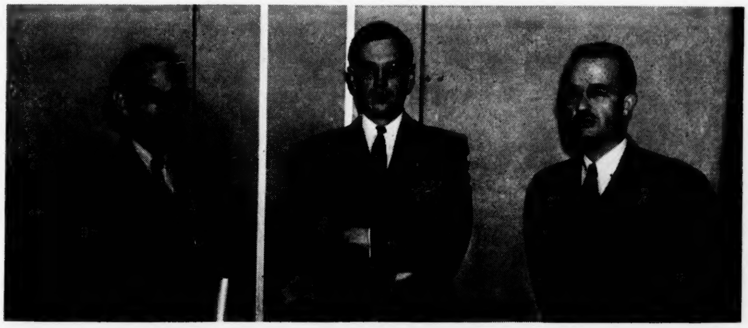
Very important is the study of the elongation away from the fracture—the so-called distribution of elongation. The reason that localized failure may take place in some steels without much of the deformation close to the failure was explained by the supposition that workhardening increases stress resistance less rapidly than the corresponding strain reduces the stress-carrying area. Consequently, the maximum formability in certain forming processes (for example, in stretch forming) would be achieved in those alloys in which the ratio of workhardening is properly adjusted to strain.

Dr. Krivobok showed numerous slides which indicated that the ductility and other related characteristics of stainless steels depend very much upon the temperature at which these properties are determined. It was shown, for example, that as testing temperature is increased, ductility as measured by standard values for elongation is lowered; on the other hand, lowering the temperature below ordinary room temperature in steels of certain compositions materially improves the ductility. These and related phenomena were discussed on the basis of workhardening.

Discussion brought out, among other things, that failure of austenitic stainless steel adjacent to a weld is frequently caused by a low-temperature draw area that reduces the ratio of workhardening to strain distortion below that required to resist rupture.

See Page 61 for Metal Congress Hotel Reservations

Chrysler Engineers Officiate at Muncie



R. D. Chapman, Research Engineer of Chrysler Engineering Division (Center), Was the Principal Speaker at the April Meeting of the Muncie Chapter. His subject was "Factors Affecting the Choice of Automotive Steels". Stanley Sowder (left), chief metallurgist of Chrysler Corp. of Newcastle, was technical chairman, and Walter F. McCormack (right), assistant metallurgist of Chrysler's Newcastle plant, and chapter chairman, presided. (Reported by G. P. Davis)

Machine Design, v. 20, June 1948, p. 133-139.

Equipment, procedures, and applications.

20a-233. Carbide-Tipped All-Depth Drills Have Wide Range of Applications. Fred W. Lucht. *Automotive Industries*, v. 98, June 1, 1948, p. 44-45, 82.

Also abstracted from *Machinery*, v. 54, June 1948, p. 156-160. See item 20a-227, 1948.

20a-234. Air Gage Controls Size of Cylinder Bore. *Compressed Air Magazine*, v. 53, June 1948, p. 143.

Equipment used in production of automobile cylinder blocks.

20a-235. Reducing Processing Time With Abrasive Wheel Cutting. J. C. Arndt. *Production Engineering & Management*, v. 21, June 1948, p. 69-71.

Many second operations on cut ends can be eliminated and an appreciable saving in time and cost effected.

20a-236. Reduced Handling Time Holds Key To Increased Production Rates. *Production Engineering & Management*, v. 21, June 1948, p. 77-79. Based on paper by Myron S. Curtis.

Faster cutting speeds with greatly increased horsepower can be overemphasized in relation to greater productivity obtainable by reducing handling time on machine tools.

20a-237. Higher Production Standards With All-Depth Carbide Drills. Fred W. Lucht. *Production Engineering & Management*, v. 21, June 1948, p. 55-60.

Abstracted from *Machinery*, v. 54, June 1948, p. 156-160. See item 20a-227, 1948.

20a-238. Hydraulic Circuits Speed Production in a Multiple Operation Machine. Robert L. Brehm. *Applied Hydraulics*, v. 1, June 1948, p. 20-22.

20a-239. Cutting and Fragmentation Formulas. Emil Kuhn. *Tool Engineer*, v. 20, June 1948, p. 22-26.

Results of studies on the fundamentals of metal cutting.

20a-240. It Pays to Experiment. George W. Bruck. *Tool Engineer*, v. 20, June 1948, p. 36.

Flood cooling and the right grinding wheels increase production and improve surface finish.

20a-241. Eccentric Forming and Turning on the Multiple Spindle Automatic. Robert Beacom. *Screw Machine Engineering*, v. 9, June 1948, p. 29-33

20a-242. Cross Slide Cam Grooving Attachment for Brown & Sharpe Automatics. Part 4. A. F. Parker. *Screw Machine Engineering*, v. 9, June 1948, p. 34-38.

Use for production of small camera part.

20a-243. Pitfalls to Avoid in Tooling Screw Machines. Part III. Noel Brindle. *Screw Machine Engineering*, v. 9, June 1948, p. 40-44.

The combination or elimination of operations to conserve on turret position; and checking for interference between turret tools and bed of turret when drilling or reaming inside the collet.

20a-244. Stock Ends. *Screw Machine Engineering*, v. 9, June 1948, p. 47.

Adjustable Grooving Tool Holder, by H. Smith; Drill Stop, by Charles Heinz; and Adjustable Over-All Length Gage, by Raymond J. Braski.

20a-245. How Gear Shaving Works. Sidney Cornell. *American Machinist*, v. 92, June 3, 1948, p. 94-98.

Basic principles of relatively new process for finishing gears.

20a-246. Practical Ideas. *American Machinist*, v. 92, June 3, 1948, p. 118-122.

Production of serrated, tapered shaft by tool held in turret lathe, by G. R. Milner; toolslide set at angle for accurate turning and boring, by E. R. Vernon; milling-way holder for rods replaces height gages, by John Neumann; conversion of vertical milling machines to jig boring by use of vernier caliper, by Chris Sorenson; use of watchmaker's bench lathe to cut off and drill small hubs, by Charles H. Willey; micrometer attachment for gaging walls of small tubing, by James Cuyler; screw-machine form-tool step protects carbide-tool insert, by W. E. Allen; changes in punch press methods stop strip-stock distortion, by S. Framurz; surface grinding of cutoff saw to reduce edge thickness, by Norman L. Naidish; drilling of 0.003-in. diameter holes in ⅜-in. annealed block, by F. Webster; fixture for tapping threaded holes in the heads of studs, by Charles H. Willey; and other miscellaneous shop hints.

20a-247. Carbide Drills. Fred W. Lucht. *American Machinist*, v. 92, June 3, 1948, p. 133, 135, 137.

Data on general design, standard sizes, methods of attachment, and drill grinding.

20a-248. Shop Shots at Electrolux. *American Machinist*, v. 92, June 17, 1948, p. 96-97.

20a-249. Bearing Housings Drilled With Rail Fixture. L. C. Heinlein. *American Machinist*, v. 92, June 17, 1948, p. 114.

20a-250. Valve-Stem Guides Finish Ground Automatically. R. R. Coulette. *American Machinist*, v. 92, June 17, 1948, p. 125.

How cast-iron valve-stem guides are handled automatically through two centerless grinders and a special washing machine.

20a-251. Practical Ideas. *American Machinist*, v. 92, June 17, 1948, p. 126-130.

Mathematical formula for location of idler in offset gear-pinion mechanism, by Henry L. Ahner; angle ground on 6-in. scale forms tool for gaging slots, by William A. Adams; prevention of breakage of small drills by magnetization, which allows easy removal of chips from the holes—the principal cause of breakage, by Elgani Stump; double-gear screw-machine tool turns external radius on shaft, by Theodore Oshinsly; cam-and-rack attachment for speeding action of vise, by Allen B. Nixon; engine-mounted hand turner trues up damaged crank pins, by John T. Zurlo; work-aligning attachment for speeding up angle-plate setup, by H. Moore; three knurled rings hold knurled part for drilling, by R. B. Ware; ball-turning lathe attachment cuts hand feed, raises speed, by Walter Milewski; improved technique for grinding chuck jaws, by Chris Sorenson; and other miscellaneous shop hints.

20b—Ferrous

20b-43. Motors for Farms. Gordon B. Ashmead. *Western Machinery and Steel World*, v. 39, May 1948, p. 66-69, 102-103, 110.

Production of four-cycle, single-cylinder, air-cooled engines mainly for farm use. Machining operations.

20b-44. Packard Transfer Line Machines 50 Blocks an Hour. Thomas E. Lloyd. *Iron Age*, v. 161, May 20, 1948, p. 72-79.

The machines and the production line are designed to permit subsequent changes in engine design by modifying present fixtures and acquiring new drill heads. Work sequences and operations.

20b-45. Slideway Grinding. Arthur Schrivener, *Machinery* (London), v. 72, May 6, 1948, p. 566-568.

Pros and cons of peripheral-wheel grinding, cup-wheel grinding, and profiled cup-wheel grinding for the slideways of machine tools.

20b-46. Economy Factors in Carbide Milling. A. O. Schmidt. *Iron Age*, v. 161, May 27, 1948, p. 72-77.

Extensive tests on three types of carbide face mills stress the importance of such factors as work rigidity, cutter feeds and speeds, work-piece hardness, carbide grade, and machine load.

20b-47. Drilling 43-Inch Diesel Camshafts With Carbide-Tipped Drills. Fred W. Lucht. *Machine and Tool Blue Book*, v. 44, June 1948, p. 139-146, 148.

The design and application of "all depth" carbide drills and their application in drilling camshafts.

20b-48. Machining 65-Ton Nickel-Chromium Steel. *Machinery*, (London), v. 72, May 13, 1948, p. 599.

Some examples of 65-ton nickel-steel components machined with tungsten carbide. Considerable savings that have been effected in operating times and tool costs by the correct application of suitable grades of tungsten carbide as compared with the use of high speed steel tools.

20b-49. Machining Cast Iron Frames for Mines Locomotives. *Machinery*, (London), v. 72, May 20, 1948, p. 615-621.

Methods used by British firm.

20b-50. The ABC of Grinding Machine Tool Slideways. R. E. Andrews. *Tool Engineer*, v. 20, June 1948, p. 30.

Profiled cup-wheel grinding insures accurate fit of mating dovetail slides.

20c—Nonferrous

20c-3. Fixtures Aid Work Handling. Walter Rudolph. *American Machinist*, v. 92, May 20, 1948, p. 96-97.

Well-planned fixtures and work-handling devices eliminate unnecessary motions.

20c-4. The Machining of Stainless Steels. W. H. Crisp and W. Burnan. *Aircraft Engineering*, v. 20, May 1948, p. 151-153.

Problems peculiar to the working of Cr and Cr-Ni steels in the machine shop.

20c-5. Combining Slotting and Burning Attachments to Perform Difficult Slotting Operation. Lawrence O. Dirk. *Screw Machine Engineering*, v. 9, June 1948, p. 23-28.

How to produce complex brass part on the automatic screw machine.

20d—Light Metals

20d-10. Carbide Tooling on the Multiple Spindle Automatic. Gus Carlson. *Screw Machine Engineering*, v. 9, May 1948, p. 37-40.

Details of production of diagrammed part from 1¼-in.-round, free-machining, Al bar stock on the 1¼-in., Model 601, New Britain automatic. This part is typical of screw-machine products that can be produced most efficiently by a combination of heavy tool feeds and high spindle speeds.

20d-11. Cross Slide Single Point Turning Tool Holder. A. F. Parker. *Screw Machine Engineering*, v. 9, May 1948, p. 52-55.

Tooling to produce aluminum dials on the automatic screw machine.

(Turn to page 42)

Metallurgical Books

By Sibyl E. Warren

Lingren Library, Mass. Inst. of Technology

A Bibliography, Classified by Subject Matter, of Metallurgical and Near-Metallurgical Books Published in the Years 1936-1946

THIS IS the fifth installment in this bibliography, which began in the March issue of *Metals Review*. The present portion starts with Section C on Mechanical Metallurgy, as shown in the classification scheme alongside. Subsequent issues will carry succeeding sections of the bibliography.

* * *

Classification Scheme

I. Metallurgy (in General)

(A) Process Metallurgy

1. Ore Dressing
2. Pyrometallurgy, Hydrometallurgy, Electrometallurgy
3. Furnaces, Refractories, Fuels, Slags, Temperature, Pyrometry

(B) Physical Metallurgy

1. Structure and Properties of Metals and Alloys
   (a) Phase Relations
2. Metallography
   (a) Microscope, Polishing, Etching
   (b) X-Ray Analysis, Radiography
3. Heat Treating
4. Testing and Mechanical Properties
5. Corrosion and Oxidation

(C) Mechanical Metallurgy

1. Powder Metallurgy
2. Casting
   (a) Pattern, Molds, Foundry Sands
3. Welding and Cutting
   (a) Electric
   (b) Gas
   (c) Soldering
4. Other Processes: Forging, Rolling, Extrusion, Drawing, Stamping, Spinning, Machining
5. Surface Treatment
   (a) Plating, Galvanizing
   (b) Enameling, Coloring, Spraying
   (c) Others

II. Metals (in General)

(a) Analysis

(A) Ferrous

(a) Biography, Economics, History

1. Iron
   (a) Cast
   (b) Iron and its Alloys
2. Steel
   (a) Special Steels

(B) Nonferrous

1. Aluminum, Magnesium
2. Brass, Bronze, and Bearing Metals
3. Copper
4. Gold, Silver, Platinum, and Other Precious Metals
5. Other Nonferrous Metals and Alloys

C. Mechanical Metallurgy

(In General)

American Society for Metals. **Working of Metals.** Society, Cleveland, 1937, 469 p.

Begeman, M. L. **Manufacturing Processes.** John Wiley & Sons, Inc., New York, 1942, 579 p.

Boston, O. W. **Metal Processing.** John Wiley & Sons, Inc., New York, 1941, 630 p.

Crane, E. V. **Plastic Working of Metals and Non-Metallic Materials in Presses.** Ed. 2. John Wiley & Sons, Inc., New York, 1939, 450 p.

Crane, E. V. **Plastic Working of Metals and Non-Metallic Materials in Presses.** Ed. 3. John Wiley & Sons, Inc., New York, 1944, 540 p.

Gregory, Edwin and Simon, E. N. **Mechanical Working of Steel.** I. Pitman & Sons, London, 1943, 198 p.

Ludwig, O. A. **Metalwork, Technology and Practice.** McKnight & McKnight, Bloomington, Ill., 1943, 397 p.

1. Powder Metallurgy

American Society for Testing Materials. **Symposium on New Methods for Particle Size Determination in the Subsieve Range.** Society, Philadelphia, 1941, 111 p.

American Society for Testing Materials. **Symposium on Powder Metallurgy.** Society, Philadelphia, 1943, 55 p.

Baeza, W. J. **A Course in Powder Metallurgy.** Reinhold Publishing Corp., New York, 1943, 212 p.

Dalla Valle, J. M. **Micromeritics: the Technology of Fine Particles.** Pitman Publishing Corp., New York, 1943, 442 p.

Goetzel, C. G. **The Influence of Processing Methods on the Structure and Properties of Compressed and Heat Treated Copper Powders.** Author, New York, 1939, 51 p.

Jones, W. D. **Principles of Powder Metallurgy.** E. Arnold & Co., London, 1937, 199 p.

Kieffer, Richard and Hotop, Werner. **Pulvermetallurgie und Sinterwerkstoffe.** Springer-Verlag, Berlin, 1943, 403 p.

McDonald, N. B. **Powder Metals: a Bibliography.** (Mimeographed) Library of Congress, Division of Bibliography, Washington, D. C., 1943, 108 p.

Metals Disintegrating Co. **The Field of Powder Metallurgy and Bibliography.** Company, Elizabeth, N. J., 1939, 48 p.

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(Turn to page 43)

20d-12. Abrasive Belt Machining. H. L. Ramsey. *Modern Metals,* v. 4, May 1948, p. 13-15.

Method of removing metal stock, surfacing, and polishing has made it possible to cut costs appreciably on several aluminum operations and offers added possibilities for removal of burrs, fins, flash, and sprues in aluminum and magnesium plants.

20d-13. Centerless Grinding Problems Solved by Using Nylon Rollers. *Steel,* v. 122, May 31, 1948, p. 85.

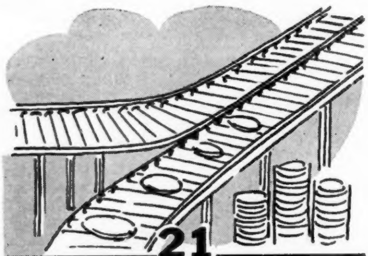
Difficulties in centerless grinding of aluminum tubing with belt machinery were alleviated by installing nylon rods. Sheet fiber rests used in the past had a tendency to pick up particles, wear fast, and consequently to mar stock being ground.

20d-14. Methods for Drilling Aluminum. *Production Engineering & Management,* v. 21, June 1948, p. 54.

Recommendations of Reynolds Metals Co.

For additional annotations indexed in other sections, see:

19a-107; 19b-69; 24a-130-164; 27a-84-89.



21 MISCELLANEOUS FABRICATION

21a—General

21a-83. Chemical Plant Fabrication. W. K. B. Marshall. *Metal Industry,* v. 72, April 23, 1948, p. 323-325, 330.

An illustrated description of activities of a British firm which is engaged in the design, manufacture, and erection of processing plant for the dairy, brewery, food, paint, pharmaceutical, and similar industries. Both ferrous and nonferrous metals and alloys are used.

21a-84. Building Servi-Cycles Better and Faster. C. H. Vivian. *Compressed Air Magazine,* v. 53, May 1948, p. 109-114.

Equipment and procedures. The Servi-Cycle is a motor bicycle plus a small "trailer" for delivery of parcels.

21a-85. Efficient Tool Engineering Cuts Motor Costs. Watson N. Nordquist. *Tool Engineer,* v. 20, May 1948, p. 33-34.

Production of electric motors.

21a-86. Subassembly Tooling. *Aircraft Production,* v. 10, May 1948, p. 164-166.

Use of Erco fixtures and riveting machine by Consolidated Vultee.

21a-87. Material Handling Efficiency Increases Output, Cuts Costs. Herbert Chase. *Iron Age,* v. 161, May 13, 1948, p. 84-89.

Combinations of stationary and portable hoppers, elevating belts, and other time-saving techniques.

21a-88. A Unique Development in the Gear Industry. *Western Machinery and Steel World,* v. 39, May 1948, p. 92-93.

Manufacture and distribution of special gears.

21a-89. Mechanizing Cleaner Manufacture Ups Output, Saves Floor Space. A. F. Murray. *American Machinist,* v. 92, May 20, 1948, p. 110-113.

Production was increased 300% with only 50% increase in floor-space by extensive conveyerizing.

21a-90. Continued Expansion Seen in Use of Power-Driven Portable Tools. *Steel,* v. 122, May 24, 1948, p. 102, 104.

The six types studied included drills, grinders, riveters, wrenches, saws or nut runners, and screw drivers.

21a-91. New Reliance Plant Features Modern Handling Methods. *Iron Age,* v. 161, June 3, 1948, p. 81.

21a-92. Versatile Skid Expedites Material Handling in Stamping Plant. L. M. Beckwith. *Iron Age,* v. 161, June 3, 1948, p. 88-89.

An adaptable skid-platform system successfully used in one plant to obtain wide flexibility from a small number of handling units.

21a-93. Conveyer System Simplifies Coil Handling at Aliquippa. C. F. Seyler. *Iron Age,* v. 161, June 10, 1948, p. 86-89.

Use of a specially engineered pallet-type conveyer system to handle steel coils weighing up to 30,000 lb.

21a-94. An Advance in Spring Fabrication Methods. Gerald E. Stedman. *Industrial Gas,* v. 26, May 1948, p. 12-13, 21-23.

Production procedure.

21a-95. Production Flow Charts. Part 5. Automobiles: Ford Motor Co., Dearborn, Mich. *Factory Management and Maintenance,* v. 106, June 1948, insert between p. 96 and 97.

21a-96. Process Control Corrects Faulty Methods. Chester S. Ricker and R. H. McCarroll. *American Machinist,* v. 92, June 3, 1948, p. 112-115.

Miscellaneous applications at Ford Motor Co.

21a-97. Revamped Fabricating Procedure Cuts Final Assembly Time of Unit Speed Heaters. L. E. Browne. *Steel,* v. 122, June 14, 1948, p. 116, 118, 120, 123, 126.

Revamped final assembly procedure, and by design and tooling changes also simplified and standardized feeder line production of parts.

21a-98. J35-A-15 Turbo-Jet Engine Production at Allison. Joseph Geschelin. *Automotive Industries,* v. 98, June 15, 1948, p. 35-37.

21a-99. Tooling Techniques at Presteel. E. J. Tangerman. *American Machinist,* v. 92, June 17, 1948, p. 91-94.

Typical inexpensive setups.

21a-100. Pneumatic Muscles Clamp and Assemble. Chester S. Ricker. *American Machinist,* v. 92, June 17, 1948, p. 112-113.

Use of air-clamping for miscellaneous heavy jobs.

21b—Ferrous

21b-42. Inside Stuff About Lockers. Paul D. Green and Cliff Cochrane. *Steelways,* May 1948, p. 5-7.

Manufacture of steel lockers.

21b-43. Corrosion Gets the Cold Shoulder. *Steelways,* May 1948, p. 18-19.

Production of stainless-steel refrigerator shelves.

21b-44. Making Heavy Duty Trucks by Mass Production Methods. *Automotive Industries,* v. 98, May 15, 1948, p. 36-37, 85-86.

Use of power-driven assembly lines and monorail conveyers.

21b-45. Building Surface Condensers. *Steel,* v. 122, May 17, 1948, p. 72-76.

Tools, welding fixtures, and fabricating methods used to machine and assemble components of steam power plants. Operations required include rolling, forming, stamping, machining, drilling, welding, and assembly.

21b-46. Practice in a Precision Shop. *Sheet Metal Worker,* v. 39, May 1948, p.53-54, 68.

Production of vending machines, cabinets, and the like, requiring close-tolerance work.

21b-47. Fabricating Stainless Steel. *Sheet Metal Worker,* v. 39, May 1948, p. 57-60, 87. Based on address by Robert Nelson.

Recommended procedures for the sheet-metal worker, costs and outlets for the products.

21b-48. Westinghouse Makes Transformers With Minimum of Metal Handling. Walter Rudolph. *Modern Industrial Press,* v. 10, May 1948, p. 28, 30, 34, 36.

Materials handling, press operations, welding, and finishing.

21b-49. Body Building at Hudson; New Assembly Approach Used To Build Rigid Integral Units. A. H. Allen. *Steel,* v. 122, May 31, 1948, p. 60-62.

Fabrication of new type of car bodies known as "Monobilt".

21b-50. Better Built to do a Better Job. *Enamelist.* v. 25, May 1948, p. 18-24.

Production of miscellaneous automotive parts and home appliances.

21b-51. New Streamlined Bearing Plant. *Steel,* v. 122, June 7, 1948, p. 74-75.

21b-52. Making Wide Band Saws. *Machinery,* v. 54, June 1948, p. 168-169.

Methods and machinery employed in manufacturing wide band saws for use in the logging industry.

21c—Nonferrous

21c-7. Streamlined Production: Band Instruments. *Production Engineering & Management,* v. 21, May 1948, p. 61-68.

Forming, machining, joining, drilling, finishing, and inspection procedures. A special brass is the principal alloy used.

21d—Light Metals

21d-4. High-Speed Deep Drawing. *Steel,* v. 122, May 17, 1948, p. 87, 90, 116.

How fast press work, modern heat-treating practice, production welding, and completely conveyerized handling are used in production of 15½-gal., light-weight, brewery barrels.

21d-5. Modern Light-Alloy Engineering. *Aeroplane,* v. 74, May 21, 1948, p. 612-614.

Aspects of work in production of "Hiduminium" and "Magnuminium".

21d-6. Materials Handling and Storage of Light Alloys. James Erickson. *Light Metal Age,* v. 7, June 1948, p. 10-14.

Effect of moisture, alloying elements, storage and transport conditions.

21d-7. Ingenious Equipment Modifications Increase Production. Rupert Le Grand. *American Machinist,* v. 92, June 3, 1948, p. 90-93.

Production of Silex steam irons from Al alloy.

For additional annotations indexed in other sections, see:

19a-119; 19b-68; 20c-3; 23d-105; 24b-65.

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Laing, J. and Rolfe, R. T. **A Manual of Foundry Practice.** Ed. 2, rev. & enl. Chapman & Hall, Ltd., London, 1938, 312 p.

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(a) Patterns, Molds, Foundry Sands

American Foundrymen's Association. **Foundry Sand Testing Handbook.** Ed. 5. Association, Chicago, 1944, 176 p.

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Spedding, T. **Patternmaking.** Percival Marshall & Co., London, 1940, 81 p.

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22 JOINING and FLAME CUTTING

22a—General

22a-116. Selecting a Resistance Welder. Ben R. Askew. *Southern Power and Industry,* v. 66, April 1948, p. 62-64, 122, 124, 126.

Recommendations as applied to various types of jobs.

22a-117. A Survey of Established Processes for the Jointing of Metals. (Continued.) D. F. Hewitt. *Sheet Metal Industries,* v. 25, April 1948, p. 771-776, 782; May 1948, p. 991-994, 1004.

April installment covers automatic and semi-automatic processes; sweat soldering; machine soldering; hard solders; silver solders; phosphorus-bearing brazing alloys; brazing brasses; copper for brazing; torch brazing; furnace brazing; dip brazing; electrical-resistance brazing; high-frequency induction brazing; salt-bath brazing; aluminum brazing; design of joints for brazing; and bronze welding. May installment deals with various types of fusion welding, including gas and arc welding of the different metals. (To be continued.)

22a-118. The Basic Principles of Resistance Welding and a Description of Some Modern Machines. C. E. Slade. *Sheet Metal Industries,* v. 25, April 1948, p. 995-1004.

(Presented at joint meeting of Institute of Welding — London Branch—and Foremen and Staff Mutual Benefit Society—Romford and Dagenham District.

22a-119. Flash Butt Welding; Experimental Spar-Bracing Tubes for the Bristol Type 167 Aircraft. Part I. The Structure: Exploratory Welding Experiments. S. G. E. Nash, H. Brooks, and M. A. Garnett. *Aircraft Production,* v. 10, May 1948, p. 167-171.

The problem, and selection and weld testing of materials. (To be continued.)

22a-120. Silicon Bronze Welded to Mild Steel. H. Hose. *Welding Engineer,* v. 33, May 1948, p. 51.

An example of how aluminum-bronze electrodes are employed in the welding of dissimilar metals is a large condenser. The tube sheets were made of Everdur 1010 silicon-bronze, plate and welded to the A-70 mild-steel sheet with 5/32-in. aluminum-bronze electrodes having a tensile strength of 60,000 to 70,000 psi.

22a-121. Weldments Show Their Advantages in Widely Diverse Designs. *Electrical Manufacturing,* v. 41, May 1948, p. 119-124.

These papers, prepared for James F. Lincoln Arc Welding Foundation contest, show a wide variety of technical situations in which weldments helped to find solutions. Fan-cooled Stator for A-C Motor, by C. R. Sutherland; Redesign of a Dough Sheeting Machine, by Joseph Boehler; Redesign Results in Fewer Parts, Increased Plant Capacity, by Ralph C. Schiring; Welding Eliminates Corrosion in a Commercial Laundry Washer, by Frank A. Gerlach; Development of a Composite Welded Frame for an Open-Back Inclinable Press, by Robert Soman; and Added Safety Through Welding in a Pressure-Jacketed Mixer, by Eugene Schmierer.

22a-122. Joints for Thin Wall Tubes. J. E. York. *Heating and Ventilating,* v. 45, May 1948, p. 84-88.

Joints used for connecting thin wall tubes made of copper, brass, steel, monel, and other alloys.

22a-123. D. C. Resistance Welding Utilizing Kinetic Energy Storage. Thomas J. Crawford. *Welding Journal,* v. 27, May 1948, p. 359-362.

Devices and apparatus developed by the resistance welding industry for reducing peak-power demand and details of a new d.c. generator operated by a three-phase motor for meeting this problem. (Presented at 28th annual meeting, A.W.S., Chicago, Oct. 18-22, 1947.)

22a-124. Power Supply for Inert-Arc Welding. A. U. Welch. *Welding Journal,* v. 27, May 1948, p. 376-378.

Advantages and disadvantages of two types developed to permit inert-arc welding with moderate power voltage. (Presented at A.I.E.E. winter general meeting, Jan. 29, 1948.)

22a-125. Welding Problems; The Function of the British Welding Research Association. H. G. Taylor. *Iron and Steel,* v. 21, May 1948, p. 150.

22a-126. Automatic Welding With a Three-Phase Arc. (In Russian.) G. P. Mikhailov. *Avtogennoe Delo* (Welding), v. 3, March 1948, p. 18-21.

Conditions of operation using the open arc or under flux. Advantages as compared to single-phase arc welding. Different circuits applicable to this type of welding.

22a-127. Measurement of Secondary Current, Voltage and Electrode Load Cycles for Spot Welding Machines. G. E. Bennett and H. E. Dixon. *Welding Research* (Bound with *Transactions of the Institute of Welding),* v. 2, April 1948, p. 26r-36r.

Important variables during the production of spot welds.

22a-128. Soldering Aluminum Alloys. Frank W. Thomas and Eli Simon. *Electronics,* v. 21, June 1948, p. 90-92.

Experiments indicate that some of the problems in soldering aluminum can be solved by vibrating the solder at an ultrasonic rate while applying it. By this method, the oxide coating is disrupted and alloying occurs before reoxidation can take place.

22a-129. Three-Phase Balanced Load Resistance Welding; Reduction of Power Demands and Costs. C. A. Burton. *Welding,* v. 16, May 1948, p. 184-192.

System and its advantages; equipment used; and cost savings.

22a-130. Cold Welding; New Developments. *Welding,* v. 16, May 1948, p. 193-194.

Recent work indicates possibilities of cold welding technique.

22a-131. Mechanized Inert-Gas Shielded-Arc Welding; Technique and Equipment. H. T. Herbst. *Welding,* v. 16, May 1948, p. 195-202, 210.

Previously abstracted from *Welding Journal,* v. 27, Feb. 1948, p. 111-117. See item 22a-60, 1948.

22a-132. Resistance Welding in Mass Production; Flash Welding Dies and Fixtures. A. J. Hipperson and T. Watson. *Welding,* v. 16, May 1948, p. 211-220, 225.

The various considerations governing the most efficient die designs for different types of components to be welded.

22a-133. Welding's Future? Harry C. Boardman. *Industry and Welding,* v. 21, June 1948, p. 30-32, 34.

22a-134. Your Pipe Welding up to Date? Carbon Steel; Aluminum; Inconel; Stainless Steel. E. G. Canada. *Industry and Welding,* v. 21, June 1948, p. 40-43, 62.

Some interesting welding problems in connection with piping installations in a modern drug-manufacturing plant. Oxy-acetylene, arc, and inert-gas shielded-arc welding combine to handle a variety of piping in diameters ranging from ½ in. to 18 in.

22a-135. Fatigue Tests of Spot Welds: Improvement of Their Endurance Limit by Hydrostatic Pressure. Georges Welter. *Welding Journal,* v. 27, June 1948, p. 285s-298s.

Spot welded Alclad 24 ST Al-alloy specimens, stainless steel and mild-steel specimens were investigated with regard to metallographic and mechanical properties in the "as-received" condition as well as after special treatment under high hydrostatic pressure. Tests revealed that an appreciable increase of endurance limit is achieved by use of high hydrostatic pressure up to 230,000 psi. At 10,000,000 cycles, an improvement of 250 to 300% of the fatigue resistance of 24 ST alloy specimens seems quite possible.

22a-136. Trade Names of Electrodes and Comparable A.W.S.-A.S.T.M. Designations. *Welding Engineer,* v. 33, June 1948, p. 67.

22a-137. Brazing and Other Applications of High-Frequency Heating. H. Bunte. *Welding Journal,* v. 27, June 1948, p. 441-444.

Fundamentals and various available types of apparatus. Methods of work handling.

22a-138. A Survey of Established Processes for the Jointing of Metals. D. F. Hewitt. *Sheet Metal Industries,* v. 25, June 1948, p. 1205-1212.

Atomic-hydrogen welding, electrical fusion welding, Weibel process, thermit process, spot, stitch, projection, seam, butt, and flash welding. (To be continued.)

22b—Ferrous

22b-159. Brazing Cast Iron; Recent American Developments with Great Potentialities. *Automobile Engineer,* v. 38, April 1948, p. 149-151. Based on paper by S. D. Heron.

Cleaning and surface-preparation process developed by Kolene Corp., Detroit, by which both machined and unmachined cast iron surfaces are prepared for silver brazing. The work is suspended in molten salts, and surface impurities are removed by alternate oxidation and reduction cycles induced by reversal of the direction of current flow. Development of more satisfactory designs of sodium-cooled pistons and cylinder blocks for application of the process.

22b-160. Tuna Clipper. Gerald Eldridge Stedman. *Welding Engineer,* v. 33, May 1948, p. 33-36.

Welded construction of newer models of above fishing vessels.

22b-161. Three-Dimensional Flame-Cutting. O. L. Bailey. *Welding Engineer,* v. 33, May 1948, p. 52-53.

How intricate shapes can be cut in one piece by first cutting the plan view, rotating the part 90 degrees and then cutting the elevation. These "burnments" are replacing numerous items formerly forged or cast.

22b-162. Welders on the Assembly Line.

(Turn to page 46)

German Nonferrous Research Described By Recent Visitor

Reported by Louis Malpocker
Lincoln Engineering Co.

Nonferrous metallurgical research developments in Germany which were investigated by S. L. Hoyt as a member of the Alsos Mission were described in a most interesting talk before the St. Louis Chapter A.S.M. on April 15. Dr. Hoyt, who is technical advisor at Battelle Memorial Institute, related his interviews with German scientists and punctuated his talk with some enlightening comments on places and persons.

At Bitterfeld Dr. Hoyt visited the light metal plants and laboratories of I. G. Farben. Here he heard about a new Elektron magnesium alloy with 50,000 psi. tensile strength and 8% elongation, and an aluminum alloy, with zinc and magnesium, of over 70,000 psi. tensile strength. The huge 30,000-ton press and the method of making aluminum propeller blades at one stroke were described.

At Jena the Carl Zeiss factory was visited, and at Urach contact was made with Prof. W. Koester, director of the K. W. Institute for Nonferrous Metallurgical Research, the principal nonferrous research establishment in Germany. Professor Koester described his work on modulus of elasticity of metals and alloys as affected by temperature, composition, and structure; new aluminum alloys with zinc and magnesium; high-temperature alloys and ceramic coatings; magnesium alloys with manganese, cerium, and mercury (mercury gives 16% elongation at 25,000 psi. tensile strength); and high-resistance nonferrous magnetic powders—a big improvement over iron powder which is commonly used for cores in electric circuits. In the physics department an ingenious line of equipment for nondestructive testing was inspected including a device known as the "Kawimeter". Used for sorting out molybdenum sealed-in wires for hard glass vacuum tubes, it has reduced leakers to practically nil.

At Hanau were the two well-known Heraeus plants, both of which were bombed out. The alloy and vacuum fusion plant was evacuated to Sterbfritz, and the precious metal work to Onstmettingen, where a special infrared filter has been developed which has to be finished to 1/25th of a microinch. Some unusual Carl Zeiss optical equipment was used for this exacting requirement.

At Munich and Weihenstephan a visit was made to Prof. Heinz Borchers, who has been working on the straight carbon reduction of bauxite to an impure aluminum and the mercury process for refining the aluminum to 99.9% purity. A plant for this process was built at Leipsic by Dr. Schmid, well known in this country for his work on aluminum and magnesium. Professor Borchers also told about depositing metal from the vapor phase on fibers and fabrics for absorbing high-frequency radio waves for protection of submarines and aircraft.

At Reutte in the Austrian Tyrol the powder metal plant of Deutsche Edelstahl Werke was visited and found to be intact and in part production. Dr. Hotop, well-known powder metallurgist, described their activities, particularly the manufacture of powder iron rotating bands and complicated steel machine gun parts on a mass production basis.

Sachs Takes Post In India, Baldwin Successor at Case

George Sachs, director of the research laboratory for mechanical metallurgy and professor of physical metallurgy at Case Institute of Technology, Cleveland, has been appointed director of the National Metallurgical Laboratory, Jamshedpur, India. The National Metallurgical Laboratory is one of five new governmental research laboratories recently established by the Indian Council for Research and Development. It will cover all aspects of metallurgical research, both fundamental and applied.

G. Sachs

Dr. Sachs will be succeeded at Case by William Marsh Baldwin, Jr., formerly process metallurgist, midwestern division, Chase Brass and Copper Co., Cleveland. Dr. Baldwin's rank at Case will be research professor in metallurgy.

W. M. Baldwin

Before assuming his new duties in October, Dr. Sachs will attend several conventions and visit plants and laboratories in Europe. While in England he will attend the Seventh International Congress of Applied Mechanics and the Institute of Metals Fall Meeting.

Dr. Sachs came to the Case faculty in 1939 from Germany, where he had been directing research and teaching and had held several executive industrial positions. He is the author of numerous papers in scientific and technical journals, and of a number of books, among them "Practical Metallurgy" (published by the American Society for Metals and with K. R. Van Horn as co-author) and "Forming of Austenitic Chromium-Nickel Alloys" (with V. N. Krivobok).

U. S. Produces 90% Of World's Supply Of Molybdenum Ore

Reported by W. L. Badger
General Electric Co., River Works

Ninety per cent of the world's known molybdenum production is accounted for by the United States, R. S. Archer of the Climax Molybdenum Co. told the Boston Chapter at its May 7th meeting. His subject was "Molybdenum in Metallurgy".

The largest source of molybdenum at the present time is a large copper producer, Climax (the speaker's company), being the second largest producer, he said. At Climax, the ore contains about 0.5% molybdenite, which is segregated by a flotation process, followed by roasting, which converts the sulphide to oxide. The oxide is converted to ferromolybdenum by the thermite process or by reduction with carbon. Molybdenum silicide is produced by the thermite process.

About 60% of the molybdenum produced is used in steel, 20% in cast iron, and the remainder as pure metal or in the chemical industries. In steel the gamma loop is closed by the addition of 3% molybdenum, raising the Ac_3 temperature. It acts both as a carbide former, or in solid solution.

The effect of the metal on hardenability was illustrated by slides; it also tends to suppress temper brittness, increase the resistance to softening, and promote secondary hardening, if present in sufficient percentages. For high-temperature applications the alloy has a beneficial effect on creep strength. In certain alloys, molybdenum increases corrosion resistance.

Turning from steel to cast iron, Mr. Archer stated that strength (at both normal and high temperature), toughness and uniformity are improved by molybdenum additions. In malleable iron, the presence of molybdenum retards secondary graphitization. Even in white iron, it improves toughness.

Metallic molybdenum has become commercially available and is useful because of its exceedingly high melting point, namely 4750° F. It is available in wrought wire, sheet and bar forms. It has recently been used as molds for high-temperature metal casting and in electronic tubes.

T. B. Jefferson. *Welding Engineer,* v. 33, May 1948, p. 56-57.

Welding phases of their fabrication.

22b-163. All-Welded Refrigerator Cars. *Welding Engineer,* v. 33, May 1948, p. 58-60, 62.

Production from low-alloy steel.

22b-164. The Effect of Welding and Other Local Heating Processes on Residual Stress and Dimensional Changes in Steel. Leon C. Bibber. *Steel Processing,* v. 34, May 1948, p. 251-255, 268.

Describes effects and clarifies them by means of charts and diagrams. How to compensate for them. (Condensed from paper presented to A.S.C.E., Pittsburgh, April 7, 1948.)

22b-165. Electric Flash Welding. *Steel,* v. 122, May 17, 1948, p. 84, 114.

Machine which heats the edges of hot-rolled strip steel and forges them together with an upsetting impact of 12,000 psi., on a new continuous pickle line. Flash is then trimmed off leaving a continuous strip of homogeneous metal.

22b-166. Development of Arc Welded Gas Holder. Arthur C. Thompson. *Welding Journal,* v. 27, May 1948, p. 363-368.

Savings of 15% over riveted construction are claimed.

22b-167. Creative Architectural Design With Welded Rigid Frames From Studies of Living Structures. Martin P. Korn. *Welding Journal,* v. 27, May 1948, p. 369-375.

Recent developments in design of welded structures.

22b-168. Ductility of Steels for Welded Structures. Augustus B. Kinzel. *Welding Journal,* v. 27, May 1948, p. 217s-234s.

Previously abstracted from *Metal Progress,* v. 52, Nov. 1947, p. 795-799. See item 22-757, R.M.L., v. 4, 1947.

22b-169. Factors Affecting the Weldability of Carbon and Alloy Steels. Development of Test Procedure and Effect of Composition. Part I. C. M. Offenhauer and K. H. Koopman. **Effect of Variations in Welding Technique on the Transition Behavior of Welded Specimens. Part II.** Clarence E. Jackson and William J. Goodwin. *Welding Journal,* v. 27, May 1948, p. 234s-266s

Investigations reported have been broadly described and summarized in the 1947 Campbell Memorial Lecture by A. B. Kinzel, p. 317s-347s. Part I is an evaluation of methods of test and the effects of composition on the embrittling temperature; and Part II is a study of the effect of variations in welding technique on the embrittling temperature of the welded specimens. Extensive data are tabulated and charted. (Presented at 28th annual meeting, A.W.S., Chicago, week of Oct. 18, 1947.)

22b-170. The Brittle Transition Temperatures of Various Low-Carbon Steels Welded by the Same Method. N. Grossman and C. W. MacGregor. *Welding Journal,* v. 27, May 1948, p. 267s-271s.

Seven low-carbon steels were investigated as to distribution of transition temperatures for different locations from the center line of the weld. All of the plates were welded by the Union melt process. Tests indicated that the weld metal was, in all cases, more ductile than the best base-plate material.

22b-171. Pipe Forming After Welding Cuts Costs for West Coast Firm. *Steel,* v. 122, May 24, 1948, p. 98-100.

Application of continuous joining and shaping on mandrels to produce irrigation tubing.

22b-172. Residual Stress and Dimensional Changes Caused by Welding and Other Local Heating Processes. *Steel,* v. 122, May 24, 1948, p. 107. A condensation.

Previously abstracted from *Steel Processing,* v. 34, May 1948, p. 251-255, 268. See item 22b-164, 1948.

22b-173. "TsM-7" Electrodes. (In Russian.) A. A. Alov. *Avtogennoe Delo* (Welding), v. 3, March 1948, p. 1-5.

A new type of coated electrode for welding carbon steel and properties of seams welded with it. Methods of production and use. The coating contains hematite, granite, ferromanganese, starch, and sodium silicate.

22b-174. Application of "TsM-7" Electrodes for Rapid Manual Welding. (In Russian.) F. I. Pashukanis. *Avtogennoe Delo* (Welding), v. 3, Marcn 1948, p. 5-10.

After investigating several types of Russian coated electrodes, it was found that the TsM-7 electrodes with an extra heavy coating were the most convenient. Compositions and optimum welding conditions.

22b-175. Determination of Conditions for Automatic Butt Welding of Non-Beveled Joints. (In Russian.) M. R. Shraerman. *Avtogennoe Delo* (Welding), v. 3, March 1948, p. 10-15.

Develops a series of nomographs which permit rapid determination of optimum conditions for automatic butt welding.

22b-176. Automatic Welding Under Flux Using Carbon Electrodes. (In Russian.) N. A. Ol'Shanskii. *Avtogennoe Delo* (Welding), v. 3, March 1948, p. 16-18.

Proposes use of carbon electrodes for welding thin carbon steel and nonferrous metal sheets (2 to 4 mm.). Optimum conditions and recommended procedures.

22b-177. L'Emploi du Chalumeau et de l'Arc Electrique dans les Travaux sous-marins. (Use of Blow Torch and Electric Arc Under Water.) M. Lebrun. *Soudure et Techniques Connexes,* v. 2, March-April 1948, p. 47-58.

Modern methods of gas and electric welding and cutting under water.

22b-178. La Construction des Grands Reservoirs a Hydrocarbures Entierement soudes. (Construction of All-Welded Tanks for Storage of Hydrocarbons.) R. Large. *Soudure et Techniques Connexes,* v. 2, March-April 1948, p. 59-69.

Methods are based on work done in the U. S. and France.

22b-179. High Manganese Steel and and Its Deposition by Arc Welding. R. W. Edwards. *Metallurgia,* v. 38, May 1948, p. 12-14, 57.

The characteristics of high Mn steel and its deposition by arc welding and some of the problems of perfecting a suitable electrode and technique for building up work-hardening surfaces. 13 ref.

22b-180. Welding of Drop-Shaped Tank. (In Russian.) M. Va. Shushenkova. *Avtogennoe Delo,* (Welding), v. 3, March 1948, p. 22-25.

Methods for construction of flattened sphere (oblate spheroid).

22b-181. Shipyard Management of Welding. W. R. Mellanby. *Transactions of the Institute of Welding,* v. 2. April 1948, p. 52-65; discussion p. 63-65, 82.

The development and control of welding, economic considerations of welding and riveting, the present methods of design, the value of prefabrication, and the future of welding.

22b-182. Ore and Coal Bridges. Geo. F. Wolfe. *Iron and Steel,* v. 21, May 13, 1948, p. 189-195.

A welded design with 15-ton grab. Extensive details of design and fabrication of the components.

22b-183. New Car Welders Promote Economy. *SAE Journal,* v. 56, June 1948, p. 34-35. Based on "Modern Welding Procedures in Building Car Bodies," by E. O. Courtemanche.

Use of multitransformer and poke-spot-welding methods.

22b-184. Submerged Melt Welding Applied to Hardenable Steels. E. A. Clapp and E. L. Frost. *Canadian Metals & Metallurgical Industries,* v. 11, May 1948, p. 19-21, 42.

22b-185. Bronze Welding of Cast Iron; Principles and Technique. E. Ryalls. *Welding,* v. 16, May 1948, p. 203-210.

Treated from practical point of view.

22b-186. Where Each Welding Method Fits the Operating Engineer's Job. *Operating Engineer,* v. 1, June 1948, p. 30-31.

Use of gas, arc, forge, braze, and thermit welding in repair of boiler and power-plant equipment.

22b-187. Construction and Maintenance of Railroad Equipment by Submerged and Gas-Shielded Electric Welding. N. G. Schreiner and J. M. Tippett. *Welding Journal,* v. 27, June 1948, p. 431-437.

Advantages of welded construction and various applications.

22b-188. Giant Test Chamber for Navy Underwater Equipment Tests. *Welding Journal,* v. 27, June 1948, p. 476, 478.

220-ton welded pressure vessel.

22b-189. Spot Welding Assembles Bath Tubs. *Welding Journal,* v. 27, June 1948, p. 478, 480.

22b-190. Tin Can Boat. Henry Schutz. *Welding Engineer,* v. 33, June 1948, p. 43, 56.

Navy pontoons joined by connector plates made a welded barge of unusual buoyancy for around $6600.

22b-191. Milk Tanks Welded From Stainless-Clad Steel. Lewis B. Adams. *Welding Engineer,* v. 33, June 1948, p. 52-54.

22b-192. Cast Glass-to-Metal Seals for High-Voltage Bushings. J. K. Easley. *Electrical Manufacturing,* v. 41, June 1948, p. 112-115.

Properties of a borosilicate glass with a coefficient of expansion matched to that of 42%-Ni iron to produce a reliable hermetic seal on large apparatus subject to wide variations in temperature.

22b-193. Semi-Automatic Submerged Arc Welding. Vladimir Peters. *Industry and Welding,* v. 21, June 1948, p. 63-64, 66.

Advantages and applications.

22b-194. Multiple Welding Procedures Speed and Improve Quality of Motor Car Body Joints. E. O. Courtemanche. *Steel,* v. 122, June 14, 1948, p. 93-95.

Also abstract from *SAE Journal,* v. 56. June 1948, p. 34-35. See item 22b-183, 1948.

22b-195. Faults to Avoid in Torch-Cutting. *American Machinist,* v. 92, June 17, 1948, p. 145.

A correctly made cut and various defective cuts.

22d—Light Metals

22d-26. Eliminating Cracking in Magnesium Arc Welds. P. F. George. *Materials & Methods,* v. 27, April 1948, p. 68-71.

Recent research work to determine why cracking occurs and how to select the proper alloy and alloy rod to produce serviceable welds. Correlation between width of solidification range and tendency toward cracking.

22d-27. Welding Aluminum. *Reynolds*

(Turn to page 48)

Die Casting Size Limitations Range From Zippers Cast on Tape to 84-In. Bus Part

Reported by John Watson
Metallurgist, Link-Belt Co.

Size limitations of die castings are of primary interest to the designer, said G. M. Rollason, general manager of the die casting division of the Aluminum Co. of America, delivering the technical address at the April meeting of the Indianapolis Chapter A.S.M.

The largest machines are capable of casting 20-lb. parts in aluminum or 50-lb. in zinc-base alloys. About 48 x 48 in. is the maximum square dimension, but longer castings may be made —for example, the 84-in. long greyhounds that ornament the sides of highway buses. Economy in handling, inspection, and assembly are the determining factors in small size limitations. Zipper parts die cast directly on the tape are about the smallest die castings commercially made.

Dimensional tolerances may be 0.0015 in. per in. Large dimensions can be held closer after a trial run. Translated into tolerance for flatness, the formula would be 1½ times the longest dimension in inches, expressed in thousandths.

The speaker then presented some basic principles of die design. To get the metal into the die, he said, gating must be such as to avoid sharp corners in the metal stream. Venting must be proper to let the air out. To get the casting out of the die impression, a compressive stress should be applied if possible, since the hot casting can withstand this stress far better than a tensile or shearing stress.

Inserts of steel or other materials may have metal cast around them. Usually there is no bond between the insert and the casting. Mechanical holding alone keeps insert and casting together, and is very effective. Methods for forming the insert include knurls, grooves, hexagon stock, crimped projections, formed bars, holes or rough machining. An example of this type of work is the Calrod heating element cast in an aluminum flat iron.

On a volume basis approximately 64% of the die castings in this country are zinc base, 34% aluminum base, and 2% divided between copper, lead, tin, and magnesium base.

Casting temperatures are about 775° F. for zinc, 1050 to 1300° F. for aluminum, and 1950° F. for copper-base alloys. Forged carbon steel dies are used for zinc base, or air hardening grades for long run work. Aluminum and magnesium usually require air hardening steel dies. The speaker expressed a personal preference for around 1% silicon in the analysis, with vanadium under 0.5%. High-tungsten steels are necessary in dies for brass, because of the temperatures encountered.

In reply to a question from the floor regarding the soundness of die castings, Mr. Rollason explained that the properties of die castings are sometimes misrepresented. They are not the equivalent of forged or wrought metals in soundness. He contended, however, that shrinkage cavities may readily be eliminated in places where harm might result from their presence.

Film on Copper Announced

The Wolverine Tube Division of the Calumet and Hecla Consolidated Copper Co., Inc., has announced a new 16-mm. sound-color movie entitled "Quality Control—From Ore to Finished Product". The film follows copper ore from the Upper Michigan mines, through its fabrication as seamless tubing, on to typical applications; it requires 40 min. to show.

Bookings can be arranged through Wolverine Tube Division, advertising department, 1411 Central Ave., Detroit 9, Mich.

Metal Treating Inst. Meets

Plans for increasing the market for heat treating services and improving the selling methods of its members were the principal subjects discussed at the Spring Meeting of the Metal Treating Institute held in Virginia Beach, Va., May 13 through 16. A method for determining basic costs of heat treating was also presented, and an inspection trip through the metalworking shops of the Norfolk Navy Base was an added feature of the meeting.

The Annual Meeting of the Institute will be held at the Adelphia Hotel, Philadelphia, starting Friday, Oct. 22, and closing on Monday, Oct. 25, just before the opening of the National Metal Congress.

Make Your Metal Congress Hotel Reservations
See Page 61

Transferred to Los Angeles

Claud S. Gordon Co. has appointed Lloyd J. Bohan as representative for its complete line in the Los Angeles area. Mr. Bohan has had wide experience in the metallurgical field and was formerly secretary of the Chicago Chapter A. S. M.

Metals Technical Advisor, v. 1, no. 7, 1948, p. 3-4.

Section VII in series from Reynolds 88-page process manual, "Welding Aluminum". Seam welding, flash welding, and brazing methods. (To be continued.)

22d-28. Crack-Free Spot Welds. E. J. Clark. *Welding Engineer,* v. 33, May 1948, p. 42-44.

Results of a series of different tests on spot-welded specimens of 0.064-in., 24 ST, Alclad, aluminum-alloy sheet indicate that the only way to attain spot welds free from internal cracks is to increase electrode pressure.

22d-29. Brazing Aluminum Alloys. H. R. Clauser. *Materials & Methods,* v. 27, May 1948, p. 78-82.

Advantages of brazing for joining Al and Al alloys; development of the process; brazing alloys and fluxes; design and properties of brazed joints; brazing methods; and typical applications.

22d-30. La Chiodatura con Ribattini Esplosivi. (Joining by Means of Explosive Rivets). *Alluminio,* v. 17, Jan.-Feb. 1948, p. 73-84.

Equipment and techniques.

22d-31. Developments in Cold Welding. *Engineer,* v. 165, April 30, 1948, p. 432-433.

Aluminum and aluminum alloys are joined by pressure alone; the pressure being applied by specially designed dies which are mounted in a suitable tool, such as a hand press.

22d-32. Cold Welding. *Metal Industry,* v. 72, May 21, 1948, p. 417-418.

Welding in the cold of A1 by pressure alone, using dies.

22d-33. Welded Aluminum Washers. C. B. Curtis. *Welding Engineer,* v. 33, June 1948, 44-45.

Equipment and procedures.

22d-34. Cold Welding of Aluminum and Its Softer Alloys. *Aircraft Production.* v. 10, June 1948, p. 211-212.

Process in which ductile metals are welded by pressure alone, the pressure being applied by specially designed dies mounted in a suitable tool, such as a hand press.

22d-35. Eliminating Cracking in Magnesium Arc Welds. P. F. George. *Welding Journal,* v. 27, June 1948, p. 273s-276s.

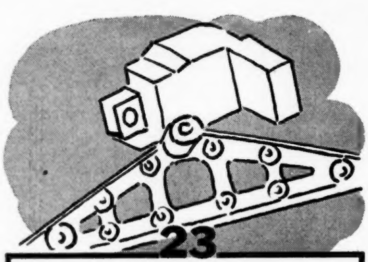
Previously abstracted from *Metal Industry,* v. 72, Feb. 27, 1948, p. 163-165, 173. See item 22d-14, 1948.

22d-36. This Unusual Series of Photographs Should Help Avoid Defects in Aluminum Alloy Spot-Welds. C. R. Dixon. *American Machinist,* v. 92, June 17, 1948, p. 98-101.

In addition to a few sound welds, examples of the most common defects.

For additional annotations indexed in other sections, see:

12a-67; 15a-7; 15b-29-32-33-35; 19b-72; 24b-70; 27a-80; 27b-34.



APPLICATIONS

23a—General

23a-23. Wire Forms. Part II. Herbert Chase. *Wire and Wire Products,* v. 23, May 1948, p. 394-398, 438.

Gives details of selection of wire, coated or uncoated, for various applications; and rules for design of products in which wire forms are incorporated.

23a-24. Furnaces Save Propeller Costs. John D. Waugh. *Automotive Industries,* v. 98, May 15, 1948, p. 40-42, 80, 82, 85.

Development of more economical fabrication techniques for the Aeromatic variable-pitch propeller. Tables show comparative costs of: (1) forged and welded hubs; (2) solid and copper-brazed blade ferrules; and (3) two-piece and one-piece plastic blade coverings. In each case considerable savings were achieved by adoption of the latter alternative.

23a-25. Examen De Cables Conducteurs en Almelec et en Aluminium-Acier Deposes Apres 15 a 25 Ans de Service. II. Observations Faites sur les Cables en Aluminium-Acier. (Investigation of High-Tension Cables Made of Almelec and of Aluminum With Steel Core After 15 to 25 Years Service. Part II. Observations Made on Cables of Aluminum With Steel Core.) Jean Herenguel. *Revue de l'Aluminium,* v. 25, March 1948, p. 73-78.

Use of galvanized steel wire and aluminum wire. Properties of each and corrosion resistance of these materials in service.

23a-26. Materials at Work. *Materials & Methods,* v. 27, May 1948, p. 72-74.

Magnesium aircraft skin; rubber propellors for outboard motors; corrosion-proof motor; embossed aluminum sheet in various patterns; aluminum shipping units which are transferred from truck trailer to boxcar; and magnesium-housed binoculars.

23a-27. Copper-Covered Steel Proves Useful for a Variety of Applications. Harold A. Knight. *Materials & Methods,* v. 27, May 1948, p. 75-77.

A permanent bond exists between the copper and steel through formation of a Cu-Fe alloy. This material, which has been widely used in the electrical industry for many years, is now being selected for a variety of parts requiring strength and corrosion resistance.

23a-28. Metals and Plastics. Robert G. Chollar. *ASTM Bulletin,* No. 153, May 1948, p. 80-87; discussion, p. 87.

Relative properties of the various commercially available metals and alloys and plastic materials for different uses. The discussion is illustrated by various examples of parts for business machines. 51 ref.

23a-29. Recent Developments in Metal Bellows. Rolt Hammond. *Machinery Lloyd* (Overseas Edition), v. 20, May 22, 1948, p. 107-108.

23a-30. Trailer Bodies Made From Subassembled Components. *Products Engineering,* v. 19, June 1948, p. 102.

23b—Ferrous

23b-30. Steel-Framed Structures Alleviate Britain's Low-Cost Housing Problem. Donavan H. Lee. *Civil Engineering,* v. 18, June 1948, p. 46-48.

Development of semi-prefabricated type of house.

23b-31. High-Strength Low-Alloy Steels. *Production Engineering & Management,* v. 21, June 1948, p. 60.

Production and properties of steels being made by 12 major steel companies in a variety of compositions and with various trade names.

23b-32. Can You Use Lower Priced Alloy Steels? A. S. Jameson. *Steel,* v. 122, June 14, 1948, p. 88-92, 106.

Application possibilities of the more economical alloy compositions such as the 1300, 4000, 4100, 5000, 5100, 9200, and 9400 series.

23c—Nonferrous

23c-35. Titanium Takes New Importance. Otto Herres. *Mines Magazine,* v. 38, April 1948, p. 19-20, 24.

Uses as metal and as oxide.

23c-36. Silver and the Platinum Group Metals in German Chemical Industry. J. M. Pirie. *Industrial Chemist and Chemical Manufacturer,* v. 24, April 1948, p. 231-239.

Uses as catalysts and as materials of construction.

23c-37. Modern Uses of Hard Metals. H. Burden. *Metallurgia,* v. 38, May 1948, p. 27-33. Reprinted from *Alloy Metals Review.*

23c-38. Die Castings in the '48 Packard. Herbert Chase, *Iron Age,* v. 161, June 3, 1948, p. 78-81.

As many as 80 die-cast parts, having a total weight of 61 lb., are used in some models.

23c-39. Beryllium in Industry. H. Manley. *Mine & Quarry Engineering,* v. 14, June 1948, p. 183-190.

Historical aspects, properties of Be and Be-Cu, and applications.

23c-40. Planned for Viewing. *Die Castings,* v. 6, June 1948, p. 37-39.

Use of Zn die castings in slide projector.

23c-41. Die Castings in the Design of Vending Machines; Get It While It's Hot. *Die Castings,* v. 6, June 1948, p. 40-43.

Chromium plated worm gears with integral pinions are among the many special gear forms attained by die casting the cup-feed mechanism of hot-coffee vendor. Power transmission elements contain many die-cast zinc components.

23-42. Carbide Inserts Rejuvenate Plastic Transfer Molds. A. L. Pranses. *American Machinist,* v. 92, June 17, 1948, p. 95.

How wear at gates and vents of transfer molds for thermosetting plastics can be minimized by use of carbide blocks inserted at critical points.

23d—Light Metals

23d-79. Freight Car Construction. R. B. Borucki and E. A. Sipp. *American Society of Mechanical Engineers, Paper* No. 47-A-79 (Advance Copy), 1947, 12 pages.

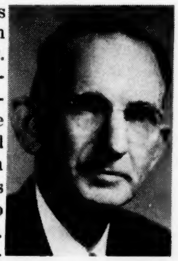
Previously abstracted from condensed version in *Railway Age,* v. 124, March 27, 1948, p. 38-41; *Railway Mechanical Engineer,* v. 122, April 1948, p. 72-75. See item 23d-64, 1948.

23d-80. Freight Car Construction. Gilbert B. Hauser. *American Society of*

(Turn to page 50)

A.S.M. Names New Public Relations Head

Walter Morrison, veteran public relations and advertising consultant, writer and radio executive, has been appointed director of public relations for the American Society for Metals. Mr. Morrison replaces Graves Taylor, who, with the exception of World War II, has been public relations consultant to A. S. M. since 1938. Mr. Taylor has resigned and is moving to Tryon, N. C.



W. Morrison

Mr. Morrison comes to the society from a post as managing editor of the *Advertiser Magazine*. He was educated in England, and during eight years he was an editorial employee of the London (England) *Times*, the New York *Mail* and the Cleveland *News*.

From 1921 to 1931, Mr. Morrison was continuity director of radio station WTAM, Cleveland. In 1931 he was appointed to the staff of radio station WHK, where he served as continuity director, production manager and director of public relations until 1935. The following ten years were spent as an advertising executive with Cleveland agencies. In 1945 he was appointed managing editor of the *Advertiser Magazine*.

Mr. Morrison will supervise newspaper, magazine, radio and other types of informational material relating to A.S.M. in addition to extending full co-operation to the society's 76 chapter public relations chairmen.

Make Your Hotel Reservations See Page 61

Latrobe Announces New Line of High Speed Steels

Latrobe Electric Steel Co. has commenced commercial production of a new line of high speed steels, to be offered for sale at prices lower than those now charged for the standard tungsten and molybdenum-tungsten grade.

Identified as the Electrite MV high speed steel group, the new steels contain chromium, molybdenum and vanadium, but no tungsten. Recommended applications include small drills and reamers, thread chasers, taps, woodworking knives and cutters, and body stock for carbide-tipped drills and reamers.

Wichita Chapter Offers Technical Services

Wichita Chapter A. S. M. has taken out a membership in the Wichita Chamber of Commerce, with E. A. Bussard of the executive committee as its representative. In an attempt to be of service to the Chamber and the industry of that area, the executive committee has passed the following resolution: "That we supply to the Chamber of Comerce or other reliable persons such general technical information as is readily available from the experience of our membership—provided such general information does not take the form of lengthy written or detailed reports."

Wichita Chapter is the only local technical society in that city to take out such a membership and offer its services in this way.

Tocco Opens Detroit Offices

The Tocco Division of Ohio Crankshaft Co., Cleveland, has opened new offices in Detroit with complete engineering, sales and service facilities covering all phases of induction heating. The new office will be under the direction of W. K. Ginman, who has spent ten years in the Philadelphia and Detroit plants of the Budd Co. (whose induction heating division was purchased earlier this year by Tocco).

Mechanical Engineers, Paper No. 47-A-89 (Advance Copy), 1947, 8 pages.
Advantages of aluminum.

23d-81. Aluminum School Buildings. *Light Metals,* v. 11, April 1948, p. 174-179.

23d-82. Light Alloys in the Internal-Combustion Engine. (Concluded.) *Light Metals,* v. 11, April 1948, p. 181-187, 189-191.
Use of light alloys for crankshafts and camshafts, connecting rods, superchargers, exhaust and silencing systems, and miscellaneous components. 24 ref.

23d-83. Magnesium in France. *Light Metals,* v. 11, April 1948, p. 192-198.
Surveys current French production and use of Mg alloys.

23d-84. Ideal Home Exhibition—1948. *Light Metals,* v. 11, April 1948, p. 204-211.
Home furniture and accessories utilizing aluminum to a large degree.

23d-85. Interstate Lays First Experimental Section of Welded Aluminum Pipe Line. Paul Reed. *Oil and Gas Journal,* v. 46, April 29, 1948, p. 141-143.
Purpose is to test the ability of aluminum pipe to resist internal corrosion by sour crude and external corrosion by corrosive soils, and also to determine economic possibilities of aluminum pipe for the petroleum industry. Inert-gas arc welding for the job.

23d-86. Die Castings in the Design of Vending Machines: Electric Cigarette Vendor. *Die Castings,* v. 6, May 1948, p. 28-30, 51-54.

23d-87. Small but Mighty. *Die Castings,* v. 6, May 1948, p. 33-34, 43-44.
Use of Al die castings for tiny lathe for precision work in the home workshop.

23d-88. Magnesium Castings—Their Production and Use. A. W. Winston and M. E. Brooks. *Mechanical Engineering,* v. 70, May 1948, p. 425-431.
Previously abstracted from *American Foundryman,* v. 13, Jan. 1948, p. 30-36, See item 23d-25, 1948.

23d-89. Aluminum Invades the Oil Field. *Business Week,* May 15, 1948, p. 92, 94.
New applications, including an aluminum pipeline.

23d-90. Impiego dell' Alluminio nei Rivestimenti Impermeabilizzanti delle Condotte Forzate per Impianti Idroelettrici. (Use of Aluminum as a Lining for Cement Ducts for Hydroelectric Power Plants in Order to Prevent Leakage.) L. Zaretti. *Alluminio,* v. 17, Jan.-Feb. 1948, p. 34-36.
Application gave good results in service.

23d-91. Les Pontes en Aluminium les Engines de Levage et les Excavateurs. (Aluminum Bridges, Cranes, and Power Shovels.) Jean Reinhold. *Revue de l'Aluminium,* v. 25, April 1948, p. 123-128.

23d-92. Le 20e Salon de la Machine Agricole. (Twentieth Agricultural-Machine Show.) Pierre Tournier and Maurice Victor. *Revue de l'Aluminium,* v. 25, April 1948, p. 129-140.
Various applications of light alloys seen at exhibition in Paris, March 2-7, 1948.

23d-93. Le Noble Fue de l'Arc. (The Noble Sport of Archery.) Maurice Victor. *Revue de l'Aluminium,* v. 25, April 1948, p. 141-145.
Use of duralumin for bows.

23d-94. Aluminum Wire. *Western Metals,* v. 6, May 1948, p. 30-31, 42.
Use of steel-reinforced Al cable on the West Coast for high-tension lines. Tables of current carrying capacity and relative weights of Cu and Al cable.

23d-95. The U. S. Army Looks At Magnesium. William H. Middleswart, J. W. Millard and R. A. Wheeler. *Magazine of Magnesium,* May 1948, p. 2-5.

23d-96. Magnesium Furniture Justified in Tradition. G. H. Friese-Greene. *Light Metals,* v. 11, May 1948, p. 236-237, 239-246.

23d-97. Aluminum at the British Industries Fair—1948. *Light Metals,* v. 11, May 1948, p. 247-300.
Aluminum products, and plant and equipment not embodying aluminum in themselves but finding some place in light-alloy technology.

23d-98. Begin First All-Aluminum Arch Bridge. *Engineering News-Record,* v. 140, June 3, 1948, p. 3.
Description of proposed structure across the Saguenay River, Arvida, Quebec.

23d-99. Precision Magnesium Plates, Made by New Technique, Eliminate Electrotypes in Test. Glenn C. Compton. *Inland Printer,* v. 121, May 1948, p.37-39.
Procedure combines a new technique of transferring, etching, and electrotype finishing to obtain a precision printing plate.

23d-100. Done to a Turn. *Die Castings,* v. 6, June 1948, p. 25, 43.
Portable home barbecue outfit has side walls of die-cast aluminum and heat resistant glass.

23d-101. Die Cast Diffuser With Integral Fins. *Die Castings,* v. 6, June 1948, p. 26-28, 44-45.
One of the principal features of the new Lewyt vacuum cleaner—its quiet operation—is made possible by use of a finned ring, die cast in aluminum.

23d-102. Making a Good Impression. *Die Castings,* v. 6, June 1948, p. 31, 45.
Embossing machine, redesigned from cast iron, utilizes Al die castings for two principal parts.

23d-103. Extruded Aluminum Doors. *Product Engineering,* v. 19, June 1948, p. 95.
Combining extruded aluminum sections and steel strips avoids use of sound deadening materials.

23d-104. Gramm Introduces First Model of Aluminum Trailer Series. *Automotive Industries,* v. 98, June 15, 1948, p. 49, 78.

23d-105. Aluminum Jewel-Tone Tile. *Modern Metals,* v. 4. May 1948, p. 19.
Production of "Muralux", a wall tile made of sheet aluminum with the edges curled to form a truncated pyramid. The tile is applied by use of a new mastic-adhesive.

23d-106. New Military Developments Will Utilize Considerable Magnesium. R. A. Wheeler. *Modern Metals,* v. 4, May 1948, p. 20-22.
(Based on talk before Magnesium Association, March 1948.)

23d-107. Residential Roofing and Siding *Modern Metals,* v. 4, May 1948, p. 24-25.

23d-108. Embossed Aluminum Provides Partially Fabricated Product. *Modern Metals,* v. 4, May 1948, p. 28-29.
Patterns and applications. The embossed pattern is said to be so attractive that additional finishing is unnecessary.

23d-109. Aluminum Spoke-Type Trailer Wheel. *Modern Metals,* v. 4, May 1948, p. 32.

For additional annotations indexed in other sections, see:
3c-35; 6d-13; 24a-156.

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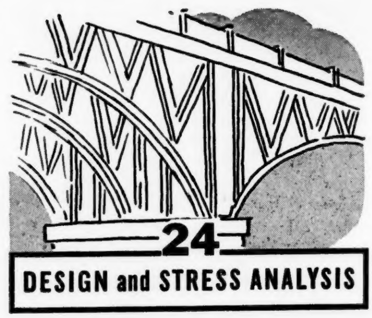

24a—General

24a-114. Compressive Buckling of Simply Supported Plates With Transverse Stiffeners. Bernard Budiansky and Paul Seide. *National Advisory Committee for Aeronautics, Technical Note* No. 1557, April 1948, 20 pages.
Charts for stability under longitudinal compression of above plates with several equally spaced stiffeners having both torsional and flexural rigidity.

24a-115. Methods of Constructing Charts for Adjusting Test Results for the Compressive Strength of Plates for Differences in Material Properties. George J. Heimerl. *National Advisory Committee for Aeronautics, Technical Note* No. 1564, April 1948, 14 pages.
Methods presented take into account differences between the compressive properties of the material used for the tests and those upon which the design is to be based. Illustrative charts for extruded 24 S-T and 75 S-T aluminum alloys.

24a-116. Buckling in Shear of Continuous Flat Plates. Bernard Budiansky, Robert W. Connor, and Manuel Stein. *National Advisory Committee for Aeronautics, Technical Note* No. 1565, April 1948, 24 pages.
As basic information for the design of thin-web spars, theoretical shear buckling stress is presented for an infinitely long, clamped plate divided into square panels by rigid intermediate supports. Shear buckling stress of a plate of infinite length and width having intermediate rigid supports.

24a-117. Nonmetallic Fuel Tanks Are Favored for Aircraft. *SAE Journal,* v. 56, April 1948, p. 34-39; discussion, p. 39. Based on "Fuel Tanks—Integral Versus Bladders Versus Metal Cells," by John E. Lindberg, Frank R. Zerilli, and C. R. Ursell.
Experiences with the various types of tanks including tanks sealed with various types of adhesive materials, and those incorporating rubber cells of three different types.

24a-118. The Stresses in a Plate Containing an Overlapped Circular Hole. Chih-Bing Ling. *Journal of Applied Physics,* v. 19, April 1948, p. 405-411.
Three fundamental stress systems. Expressions of stress along the rim of the hole, and values of the maximum stress. Results are plotted in conjunction with those of a plate containing two equal circular holes.

24a-119. Progressive Die Design, Part IV. C. W. Hinman. *Modern Machine Shop,* v. 20, May 1948, p. 134-136, 138, 140, 142.
The value of "stepped dimensions" for die layout.

24a-120. Dies for Drawing Complex Shapes. Charles R. Cory. *Machinery,* v. 54, May 1948, p. 155-162.
Design of dies for parts requiring a two-way punch action or more than one drawing operation.

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Speaks on Employee Relations

Ralph L. Lee, of the Public Relations Department of General Motors, Addressing the Saginaw Valley Chapter A. S. M. on Ladies' Night

Reported by A. Waydak
Chevrolet-Flint Mfg. Div., G. M. C.

For the first time in its 11-year history, Saginaw Valley Chapter A. S. M. held a ladies' night. The speaker of the evening at this event, which took place May 18 in Frankenmuth, Mich., was Ralph L. Lee, member of the public relations department of General Motors Corp., and author of "Man to Man on the Job". His subject for the evening was "Facing Facts in Employee Relations".

"Even though we have made great technical strides", Dr. Lee said, "no one has yet invented a 'Humanometer' with which to measure and evaluate the human element. Everyone is different and we have had and always will have the bullies, clowns, pouters, gripers, dead - pans, ant - in - the - pantsers, lead-in-the-pantsers and those that run off at the mouth when all we want is 'yes' or 'no'.

"No one can change as much as we want them to," he continued, "and no one is the same all the time. But people are proud of being individualists, so we must respect their differences.

"Employee relationships must be based on the feeling of good-will. This cannot be mass-produced, but must be developed through mutual understanding and a respect for the individual's limitations along with their abilities", he concluded.

After the talk, color-sound movies of "Michigan Canoe Trails" and "Michigan Porcupine Mountain State Park" were shown.

This was the final meeting of the 1947-48 season and marked the retirement of the current chapter officers and installation of new ones.

Zimmerman Replies to Critics Who Advocate Expanded Steel Capacity

Reported by R. P. Nevers
Chemist, American Brass Co.

Taking sharp issue with critics of the American steel industry on the question of capacity, R. E. Zimmerman, vice-president, research and technology, United States Steel Corp., declared that the industry has expended vast amounts in the past eight years to enlarge and improve its facilities. His statement was made in an address before the New Haven Chapter A.S.M. on May 20.

Dr. Zimmerman said that the industry had decided on a sound and orderly course of expansion so as to maintain steel prices at the lowest possible level. Steel production last year represented an increase of 60% over 1939, a thought-arresting comparison, he pointed out. Last year, operating at an average 93% of rated capacity, the steel industry in the United States produced 84,800,000 tons of ingots, or 63,000,000 tons of finished rolled products. This represents between 53 and 54% of the total world production of steel.

"Ingots cannot be produced by providing simply openhearth, bessemer, and electric furnace facilities", Dr. Zimmerman continued. "There must be something to charge into the furnaces. The necessary iron can be provided by building more blast furnaces, but they in turn must be fed with ore and coke. Additional ore can be mined if additional mines are developed. There must be additional boats and cars to transport it from the mines to the blast furnaces.

"It is a well-known fact that construction costs have been mounting rapidly in recent years. To provide balanced new capacity in a fully integrated steel plant now requires the expenditure of approximately $300 per yearly ton of salable product. The depreciation charge against this product, at the present rate, becomes $12 per ton. That immediately poses a troublesome economic problem because the average proceeds per ton, from the sale of finished steel at prevailing prices, cannot absorb such a high depreciation charge. Higher prices, in our present economic situation, do not constitute a preferred or desirable method of procedure if they can be avoided.

"So the statement that steel prices are surprisingly low is readily defensible", the speaker concluded. "Even so, it is hardly possible that those who have been advocating publicly that the steel industry proceed forthwith to expand by another ten million tons would be the first to defend or condone the higher prices necessary to defray the added cost of expensive new equipment."

Radioactive Isotopes Improve Techniques In Metallurgy

Reported by Melvin R. Meyerson
Metallurgist, National Bureau of Standards

Before the Washington Chapter, on April 12, R. Smoluchowski, associate professor of metallurgy at Carnegie Tech, revealed the remarkable results obtained and the future possibilities of using radioactive isotopes in metallurgical research and testing. These materials, by acting as tracers which are introduced to nonradioactive metals and are located within the metal by appropriate treatment, have improved existing techniques in metallurgical fields (more accurate analysis, nondestructive testing) as well as opened new fields of metallurgical research.

Not all elements in radioactive form are useful in metallurgy. The speaker's list of useful radioactive elements included H, Be, C, P, S, Sc, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ge, Zr, Mo, As, Cd, Sn, Sb, W, Au, and Hg. Several of these elements are being used at Carnegie Tech. These materials emit three types of radiation, known as alpha, beta, and gamma, of which the beta has characteristics most adaptable to metallurgy.

Dr. Smoluchowski described many problems in both physical and process metallurgy which can or may be solved with radioactive isotopes. Clarification of the mechanism of the growth of pearlite, and the mechanism of the oxidation of copper are typical examples. In the latter, definite evidence has been obtained to show that the copper on the surface oxidizes first, and that the copper layer under the oxide layer diffuses up through the oxide until it reaches the surface, where it is oxidized.

Other fields of application include diffusion, properties of grain boundaries, autoradiography and problems in process metallurgy.

In his comprehensive lecture, Dr. Smoluchowski also described verbally and with slides the fundamental physical concepts of radioactivity, two types of beta-ray counters, the photographic method of detection, energy emitted by various isotopes over a period of time, and many other phases of the subject.

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24a-121. Tool Engineering Ideas. *Machinery,* v. 54, May 1948, p. 182-183.

Grinding Attachment for Vertical Turret Lathe, Harold E. Murphey; and Special Chuck and Fixture for Precision Taper Boring, Donald A. Baker.

24a-122. Photo-Elastic Investigation of Stress-Relieving Fillet Curves. Everett Chapman. *Product Engineering,* v. 19, May 1948, p. 138-141.

Equipment required and preparation of photo-elastic models. Analysis of stresses in blending curves of a keyway fillet and effect of elliptical blending curves of different eccentricities.

24a-123. Selection of Engineering Materials for Coke Plants. Part II. C. F. Pogacar. *Blast Furnace and Steel Plant,* v. 36, May 1948, p. 555-559.

Wear and various types of corrosion as metallurgical factors to be considered in alloy selection.

24a-124. Metallurgical Aspects in the Design of Rocket Motors. J. N. Nutt. *Journal of the American Rocket Society,* March 1948, p. 31-34.

A general discussion.

24a-125. Present Day Plain Bearing Practice. W. H. Tait. *Industrial Diamond Review,* v. 8, April 1948, p. 118-122; discussion, p. 122-124. Condensed from *Journal of Institution of Production Engineers,* v. 26, March 1947, p. 75-92; April 1947, p. 111-125.

Requirements of bearing materials, properties of various materials, and design structural factors.

24a-126. The Brittle Lacquer Method of Determining Stresses. *Metallurgia,* v. 37, April 1948, p. 290-292.

Method is briefly described; compositions of brittle lacquers and some of their properties.

24a-127. Analytical Determination of Radial Cam Profiles. Gordon M. Sommer. *Tool Engineer,* v. 20, May 1948, p. 17-22.

For shops that lack special cam-machining equipment, yet are occasionally required to produce very accurate cams with such equipment as milling machines and index heads. Properly applied and used, the formulas and data given will eliminate all tedious cam layout.

24a-128. Investment Castings. W. O. Sweeney and H. L. Mattes. *Machine Design,* v. 20, May 1948, p. 91-97.

Advantages and limitations. Tips on designing better parts at reasonable cost.

24a-129. Elastic Matching Improves Bearing Life and Performance. J. G. Baker. *Machine Design,* v. 20, May 1948, p. 106-110.

An award-winning paper in the recent "Design-For-Progress Program" sponsored by The James F. Lincoln Arc Welding Foundation. Proper loading of bearings is achieved by matching the elastic deflections of bearing supports and shaft elements.

24a-130. Production Processes—Their Influence on Design. Part XXXIII—Production Grinding, Design Factors. Roger W. Bolz. *Machine Design,* v. 20, May 1948, p. 111-117.

24a-131. Cutting Production Costs? Watch Design Details! A. F. Murray. *Machine Design,* v. 20, May 1948, p. 126-128.

(Based on paper presented at recent A.S.M.E. annual meeting.)

24a-132. Designs of the Month. *Machine Design,* v. 20, May 1948, p. 146-149.

Centerless grinder ways protected by simple design; three-dimensional pantograph employs novel ratio bar; and temperature controlled electronically in automatic flame hardener.

24a-133. Calculating Deflections of Hollow Shafts in Torsion. Carl P. Nachod. *Machine Design,* v. 20, May 1948, p. 151-152.

Presents nomograph and explains its development.

24a-134. Electrical Contacts of the Strainometer in Operation. (In Russian.) G. E. Rudashevskii. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk.* (Bulletin of the Academy of Sciences of the U.S.S.R., Section of Technical Sciences.), Jan. 1948, p. 19-22.

Factors responsible for errors in the Strainometer. It was found that the main factors were defective contacts between the moving-shaft and the brushes. A series of practical remedies.

24a-135. Electrical Resistance Wire Strain Gages; Their Development and Use. (Concluded.) J. Edwards. *Metal Treatment,* v. 15, Spring 1948, p. 17-26.

The cements and adhesives required, the circuits used for measuring static, slowly varying, and dynamic stresses; and torques in shafting. 38 ref.

24a-136. Plasticity for the Aerodynamicist. William Prager. *Journal of the Aeronautical Sciences,* v. 15, May 1948, p. 253-262.

Classical theory of plasticity (Saint Venant-Mises theory) as applied to problems of plane plastic flow. 11 ref.

24a-137. Inelastic Column Theories and an Analysis of Experimental Observations. Chi-Teh Wang. *Journal of the Aeronautical Sciences,* v. 15, May 1948, p. 283-292.

The inelastic buckling problem is treated from a rigorous mathematical point of view. The effect of assuming a constant tangent modulus on the buckling load in the tangent modulus formula. Many anomalies of column behavior in the inelastic region are explained. 10 ref.

24a-138. Comparator Chart Layout Checks Involute Gears. F. E. Browning. *American Machinist,* v. 92, May 20, 1948, p. 89-92.

Quick, accurate checking of involute gears is done on a comparator with a master chart laid out by calculating points outlining tooth profile.

24a-139. Wear Resistance Measured in Laboratory and Shop. N. N. Sawin. *American Machinist,* v. 92, May 20, 1948, p. 98-101.

Fundamentals of wear and its measurement. Recommends more attention to this factor in fields other than railroad rails and bearings, where it has already been extensively studied. Wear of both metallic and nonmetallic materials.

24a-140. Texturized Metals Find Wide Application. A. H. Allen. *Steel,* v. 122, May 24, 1948, p. 94-97, 119-120.

Design-strengthened sheet and strip in a wide range of metals of varying gages and degrees of hardness are found to possess improved rigidity, buckling strength, impact and tensile strength, as well as appearance.

24a-141. Experiences in the Design of Aircraft-Motor Parts and in Investigation of Their Failures. (In Russian.) R. S. Kinasoshvili. *Collection of Reports Concerning the Dynamic Strength of Machine Parts,* Academy of Sciences of the U.S.S.R. 1946, p. 195-209.

A method for the computation of stresses in different parts of airplane engines. Some part failures are attributed to poor correlation between test data obtained for materials in the laboratory and true properties which are in evidence during actual operation.

24a-142. Experimental Investigation of the Strength of Metals and Joints in Construction of Electrical Machinery. (In Russian.) I. A. Oding and F. V. Kulikov. *Collection of Reports Concerning the Dynamic Strength of Machine Parts,* Academy of Sciences of the U.S.S.R., 1946, p. 238-253.

The study of the phenomena of fatigue, creep, and internal stress is complicated by the existence of specific peculiarities in the design of such machinery.

24a-143. An Automotive Designer's Concept of Steel Vs. Light Metals. D. F. Toot, *Society of Automotive Engineers, Preprint,* 1948, 6 pages.

Engineering properties of aluminum, steel, and cast iron from the viewpoint of an automotive-part designer.

24a-144. The Measurement and Interpretation of Post-Yield Strains. Keith Swainger. *Proceedings of the Society for Experimental Stress Analysis,* v. 5, No. 2, 1948, p. 1-8.

Properties of new British alloy, Minalpha (85% Cu, 12% Mn, 3% Ni), used as wire.

24a-145. On the Removal of Time Stresses in Three-Dimensional Photo-Elasticity. Max M. Frocht. *Proceedings of the Society for Experimental Stress Analysis,* v. 5, No. 2, 1948, p. 9-13.

It was found that time stress developed in a body as a whole tends to disappear in sections cut from it if sufficient time is allowed for recovery. This release of the time stresses in sections of a body was utilized with good success in photoelastic studies of thick slotted plates.

24a-146. Equivalence of Photo-Elastic Scattering Patterns and Membrane Contours for Torsion. D. C. Drucker and M. M. Frocht. *Proceedings of the Society for Experimental Stress Analysis,* v. 5, No. 2, 1948, p. 34-41.

A simple theoretical derivation supported by experiment to show that photo-elastic scattering patterns can be obtained which are in every way the same as membrane contours for pure torsion. 10 ref.

24a-147. Three-Dimensional Photo-Elastic Analysis by Scattered Light. Ernesto M. Saleme. *Proceedings of the Society for Experimental Stress Analysis,* v. 5, No. 2, 1948, p. 49-55.

A mathematical development is followed by results of experimental work on the case of a semi-infinite block under concentrated axial load.

24a-148. Stress Distribution Around a Hole Near the Edge of a Plate Under Tension. Raymond D. Mindlin. *Proceedings of the Society for Experimental stress Analysis,* v. 5, No. 2, 1948, p 56-68.

A mathematical solution which shows that the stress at the point on the edge nearest to the hole is always tensile, but approaches zero as the hole approaches the edge of the plate. The calculated results are compared with those obtained by photo-elastic analysis of Bakelite models. Qualitative agreement was observed.

24a-149. Response of Damped Elastic Systems to Transient Disturbances. R. D. Mindlin. *Proceedings of the Society for Experimental Stress Analysis,* v. 5, No. 2, 1948, p. 69-87.

A procedure, suitable for engineering applications, for taking into account energy dissipation in the various modes of flexural motion in a bar. Use of Sezawa equation.

24a-150. Electric Strain Gage Analysis of a 50-ft. Hortonsphere. Given Brewer. *Proceedings of the Society*

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Weak-Brittle Structure Recommended By McMullan for Good Machinability

Reported by Robert T. Hook
Assistant Metallurgist, Warner & Swasey Co.

Good machinability is to be obtained from a weak-brittle structure, according to O. W. McMullan, chief metallurgist of the Bower Roller Bearing Co., who spoke before the Cleveland Chapter A.S.M. at the last meeting of the season. Such a structure should be of microscopic or, at most, fine macroscopic dimensions to produce an aggregate that might be characterized as having uniform lack of uniformity along the cutting edge of the tool at all times.

In carbon steels and lower-alloy steels of medium carbon content, best machinability (as measured by tool life and degree of finish) is had with a structure of coarse-grained, open, lamellar pearlite with ferrite around the grain boundaries. This provides the best balance in the weakness-brittleness relationship. Such a structure automatically falls within the hardness range of Brinell 140 to 200.

When chemical composition is such that a pearlitic structure entails hardness below this range, the steel is weak but lacks brittleness. Insofar as hardness is a measure of brittleness, the hardness must then be increased even at the sacrifice of any preconceived ideal structure. This can be done by cold work, by alloying elements in the ferrite such as manganese, or by faster cooling even to the point of drastic quenching.

On the other hand, when hardness rises much above Brinell 200, the weakness factor diminishes and something must be done to decrease hardness regardless of what happens to the structure. Only one procedure is possible—more and more complete spheroidization as carbon and alloy contents increase.

Other than a possible lubricating effect, the influence of foreign inert materials (sulphur, selenium, graphite, lead) is primarily on the brittleness factor. It is favorable rather than adverse to weakness; hence their inherent tendency is to improve machinability regardless of the distribution, hardness and toughness of the other constituents.

A coarse, austenitic grain lowers the impact value and, for an equal strength, would have a favorable influence on the brittleness factor and improve machinability. The higher temperatures required to produce the coarse grain size, however, tend to decrease the spacing of pearlite lamellae and increase the hardness. This is not objectionable in the low-carbon steels, but may be in the medium or higher carbon steels.

Fundamentally, surface finish may be considered as reflecting the size of the structural unit in which rupture takes place through failure at the grain boundaries and in tension or shear across planes of weakness in the grains. Practically, however, failure of the metal does not take place in a single plane or closest plane of weakness to that in which the cutting edge travels. Irregular wear and damage to the tool edge, built-up metal on the cutting edge, stresses in the chip, all enter the picture. Structures minimizing these effects may therefore give better finishes than those of finer grain.

Machinability must be considered as a means to an end and not the end in itself. It must often be partially sacrificed to improve other processing operations, performance of the part in service, or to lower costs.

Promoted to Vice-President

James C. Hartley has been appointed vice-president, general manager and director of Barium Steel and Forge, Inc., Canton, Ohio, succeeding Glen W. Shetler, who has resigned. Mr. Hartley joined the firm in 1946 as chief metallurgist, and in 1947 was made manager of metallurgy and sales.

Founder and President of Gibson Electric Co. Dies

A. B. Gibson, 55, founder and president of the Gibson Electric Co., Pittsburgh, died June 5. The Gibson Electris Co. was founded by Mr. Gibson in 1933, and from the beginning specialized in contact materials made by powder metallurgy processes. Under his direction new electrical contact materials were developed known under the trade name of Gibsiloy.

Mr. Gibson was a member of the American Society for Testing Materials and the A.S.M., and was a past president of the Western Pennsylvania Industrial Conference.

He graduated from Clarkson College of Technology with the degree of Bachelor of Science in Mechanical Engineering in 1916. He was awarded the honorary degree of Doctor of Engineering by the same school in 1947. Mr. Gibson was employed by the Westinghouse Electric Corp. for many years, part of the time as manager of the Westinghouse Technical Night School. In 1929 he was made vice-president of the Stackpole Carbon Co., and remained there until 1933, when he founded the Gibson Electric Co.

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for Experimental Stress Analysis, v. 5, No. 2, 1948, p. 88-94.

Procedures used and results. 26 ref.

24a-151. The Photogrid Process for Measuring Strain Caused by Under water Explosions. D. D. MacLaren. *Proceedings of the Society for Experimental Stress Analysis,* v. 5, No. 2, 1948, p. 115-124.

The applicability of the Eastman Kodak Transfax process. Standard techniques for the complete process by means of a series of discussions of actual test results.

24a-152. The Design and Construction of Cathode Ray Tubes. R. H. Craig. *Nickel Bulletin,* v. 21, March 1948, p. 30-33.

With choice of metals and insulating materials used in their construction.

24a-153. Impact Loading of Structures. D. Laugharne Thornton. *Engineering,* v. 165, April 30, 1948, p. 409-412.

Theoretical discussion of the effects of impact loading on various materials of construction.

24a-154. Experimental Method of Stress Analysis. J. H. Lamble. *Engineering,* v. 165, May 7, 1948, p. 436.

Simple method using a cheap, impure resin, instead of "Stresscoat" lacquer.

24a-155. The Technological Principles of Casting Design. *Machinery Lloyd* (Overseas Edition), v. 20 May 8, 1948, p. 82-85.

24a-156. Airscrew Turbines; Materials Used in the Armstrong Siddeley "Mamba". *Iron and Steel,* v. 21, May 13, 1948, p. 186-188.

Large diagram showing constructional details of new British aircraft powerplant and the alloys used in the various parts.

24a-157. Some Evaluations of Stresses in Aneroid Capsules. H. C. Grover and J. C. Bell. *Proceedings of the Society for Experimental Stress Analysis,* v. 5, no. 2, 1948, p. 125-131.

Results from an experimental study of pressure-sensitive capsules. The primary purpose was a study of drift and mechanical hysteresis in such capsules and the development of methods for producing capsules with less drift and hysteresis than now prevalent. Two studies carried out; results of each presented and compared.

24a-158. Stresses in Two-Wire Glass-to-Metal Seals. O. Adams. *Journal of the Society of Glass Technology,* v. 32, April 1948, p. 99-112.

Behavior of glass in plane stress when examined in plane polarized light. Estimation, by Filon's graphical integration method, of the principal stresses in two-wire glass-to-metal seals.

24a-159. Rekstrookjes. (Strain Gages.) C. H. Gibbons. *Metalen,* v. 2, May 1948, p. 187-193.

Development of the SR-4 strain gage, principles of its construction and application, and limitations of different types. Ways of measuring and recording resistance of differentials. Possibilities of extension of applications.

24a-160. The Analysis of Strain and Its Graphical Representation. A. H. Willis. *Engineering,* v. 165, May 14, 1948, p. 457-460.

A mathematical presentation of value to engineers using strain-gage equipment.

24a-161. Leaf-Spring Deflection. J. E. Reeve. *Machinery* (London), v. 72, May 20, 1948, p. 624-625.

Calculations said to simplify evaluation of line integrals, in connection with article by Heller in Feb. 26 issue.

24a-162. What Kind of Information Does Brittle Coating Give? Part I. A. J. Durelli. *Product Engineering,* v. 19, June 1948, p. 86-91.

Analysis of isostatic and isoentatic patterns in brittle coatings for different combinations of stresses, and formulas enabling the calculation of stresses with higher accuracy than that usually obtained. Use of refrigerating technique to obtain isostatics in zones where the strain is smaller than strain sensitivity of coating. (To be continued.)

24a-163. What Recent Research Offers the Designer. Norman C. Penfold. *Machine Design,* v. 20, June 1948, p. 107-112.

A broad, illustrated survey.

24a-164. Scanning the Field for Ideas. *Machine Design,* v. 20, June 1948, p. 113-115.

Electronic control equipment for Monarch lathe; bearing with spring-mounted jewel; hydraulic pitman with automatic cutout for overload; cemented-carbide inserts for wear resistance of cams on boring machine; and air-mercury sizing control for gaging the workpiece of a grinder.

24a-165. How to Reduce Costs of Thin Metal Stampings. Wallace C. Mills. *American Machinist,* v. 92, June 3, 1948, p. 99-106.

How to establish "teamwork" among processes or operations, especially when line production is involved. Results of considerable experience in investigating savings from tool designs and methods suitable to various speeds of output.

24a-166. Gear Measurement Over Nonstandard Pins—Discussion. Louis D. Martin. *American Machinist,* v. 92, June 3, 1948, p. 109-110.

Louis D. Martin, Ralph A. Miner, and R. Parks take exception to method recently described by E. J. Rantsch (Jan. 29 issue) and show other methods of calculation.

24b—Ferrous

24b-64. Prevention of Mechanical Failures in Steel Plant Equipment. Oscar J. Horger and Gordon A. Stumpf. *Iron and Steel Engineer,* v. 25, May 1948, p. 69-76; discussion, p. 77.

Many failures may be prevented by correct initial designs which reduce stress concentrations. Cold working to introduce residual stresses at critical points will eliminate many more breaks. (Presented at A.I.S.E. Annual Convention, Pittsburgh, Sept. 25, 1947.)

24b-65. Trends in Design and Application of Lifting Magnets. John D. Leitch. *Iron and Steel Engineer,* v. 25, May 1948, p. 78-86; discussion, p. 87-91.

New electric magnet in a welded design gives a sealed unit which prevents the entrance of moisture, and allows the design of a flatter coil which aids in heat dissipation. Uses in steel industry. (Presented at A.I.S.E. Annual Convention, Pittsburgh, Pa., Sept. 23, 1947.)

24b-66. Tendency Toward Shaft Failures in Marine Steam Engines. (In Russian.) V. A. Anichkov. *Collection of Reports Concerning the Dynamic Strength of Machine Parts,* Academy of Sciences of the U.S.S.R., 1946, p. 210-219.

Need for investigation of factors causing such failures and results of this investigation.

24b-67. Failures of Seagoing Ship Propellor Shafts. (In Russian.) A. V. Efimov. *Collection of Reports Concerning the Dynamic Strength of Machine Parts,* Academy of Sciences of the U.S.S.R., 1946, p. 220-224.

Specific operating conditions and main factors responsible for failures which are said to be quite different from those involved in stationary-engine operation. Suggestions for preventing failures.

24b-68. Mechanical Properties of Metals and Strength of Axles. Railroad Rolling Stock in Service. (In Russian.) V. N. Makhov. *Collection of Reports Concerning the Dynamic Strength of Machine Parts.* Academy of Sciences of the U.S.S.R., 1946, p. 225-237.

It is stated that the majority of above failures are caused by overloading and by poor impact strength of the steels used. Recommends drastic revision of existing specifications.

24b-69. Allowable Stresses for Steel Members of Finite Life. G. C. Noll and M. A. Erickson. *Proceedings of the Society for Experimental Stress Analysis,* v. 5, no. 2, 1948, p. 132-143.

Data in the form of diagrams for solution of practical structural problems. Effects of number of stress cycles, of mode of stress variation, of surface finish, and of stress concentration in arriving at the final diagrams.

24b-70. Fatigue Tests of Welding Elbows and Comparable Double-Mitre Bends. A. R. C. Markl. *Welding Journal,* v. 27, June 1948, p. 310s-320s.

Previously abstracted from *Transactions of the A.S.M.E.,* v. 69, p. 869-876. See item 24-403, R.M.L., v. 4, 1947.

24d—Light Metals

24d-19. On Proof Stress in Compression. G. D. Chapman. *Light Metals,* v. 11, April 1948, p. 199-203.

Any variation of true proof stress in compression from that in tension for light alloys is probably caused by structural or mechanical heterogeneity.

24d-20. Tests of Cast Aluminum-Alloy Mixed-Flow Impellers. John E. Douglas and Irving R. Schwartz. *National Advisory Committee for Aeronautics, Wartime Report* No. E-277, April 1946, 15 pages.

Results showed that the cast impellers of one the alloys are suitable for use in superchargers up to tip speeds of at least 1200 ft. per sec.

24d-21. Biaxial Plastic Stress-Strain Relations for 24S-T Aluminum Alloy. Joseph Marin, J. H. Faupel, V. L. Dutton. and M. W. Brossman. *National Advisory Committee for Aeronautics Technical Note* No. 1536, May 1948, 96 pages.

Biaxial tensile stresses were produced in a tubular specimen by a specially designed testing machine which applies both an axial tensile load and an internal pressure to a tubular specimen, thereby producing biaxial tensile stresses in the tube wall. Strains were measured in the plastic range up to rupture by means of special electric SR-4 clip gages. Stress-strain data were obtained from flat control specimens cut from the tubular specimens and compared with tension-test data obtained from tubular specimens. Except for ductility values, the results show good agreement.

24d-22. A Check List for the Designer in Magnesium. *Magazine of Magnesium,* May 1948, p. 8-11.

Properties.

For additional annotations indexed in other sections, see:

3b-74; 11-147; 14d-38; 20a-227-232; 27a-82-88.

(Turn to page 56)

Why Cr-Ni Stainless Is Favored Over Straight Cr Steels Explained

Reported by Richard L. Priess
Southern Power & Industry

The ratio in the industrial utilization of chromium and chromium-nickel steels (based on A.I.S.I. statistical studies) is about 1:2. Why chromium-nickel steels are favored by industry, despite their higher cost, was discussed by V. N. Krivobok of the International Nickel Co. at the April dinner meeting of the North Texas Chapter A.S.M. in Dallas.

Dr. Krivobok compared the two classes of stainless steels as to mechanical properties, corrosion resistance, formability, and production problems.

Since high mechanical properties in chromium-nickel steels are produced by cold rolling, this is the convenient and economical method of securing material of exceptional properties in flat forms. An alloy with 18% chromium and 8% nickel has, in many corrosive environments, the same or about the same resistance to corrosion as an alloy with 28% chromium. For equal resistance to corrosion, the austenitic chromium-nickel stainless steels have materially better forming characteristics and adapability for assembly. In addition, production problems, such as scale removal and cleaning, are more numerous in chromium steels.

Utilizing a series of slides, Dr. Krivobok pointed his discussion toward the mechanical properties. Chromium-nickel alloys of higher rates of cold workhardening, he showed, retain greater ductility and ability to form into various shapes. Furthermore, cold rolling does not exhaust the ability of these alloys to take on additional workhardening. Therefore, stressing above the yield strength—and in fact even below the yield strength—results in further hardening and strengthening.

The speaker further observed that for a given amount of cold work, the attainable properties are a function of analysis, while the properties in tension and compression are a function of rolling direction.

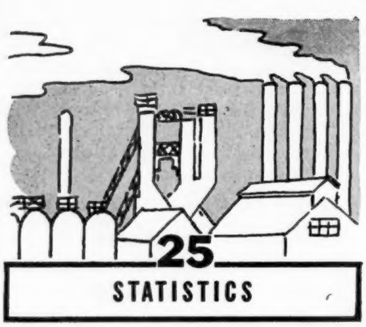
Dr. Krivobok concluded by discussing the effect of temperature of testing on the mechanical properties. In many steels and alloys lowering the temperature of testing results in a considerable increase in the observed strength (both tensile and breaking), but this increase is accompanied by a pronounced drop in ductility. Chromium-nickel steels do not follow this general pattern. As the temperature is lowered, the strength and ductility become greater. The more stable the alloy the more pronounced is the increase in ductility. This observation of increased ductility at subzero temperature is in good correlation with the well-known toughness of chromium-nickel stainless steels even at very low temperatures.

Named by U. S. Steel As Vice-President, Sales

J. Douglas Darby has been elected vice-president in charge of sales of Carnegie-Illinois Steel Corp., succeeding Thomas J. Hilliard, resigned.

J. D. Darby

Mr. Darby received his education at Yale University graduating in 1919. First employed as a slagman in the openhearth department of the Alan Wood Steel Co., he rose through various positions in his 20 years of service there to become general superintendent and later assistant to vice-president of sales. He joined the sales department of Carnegie-Illinois in 1939 and that year was made district manager of sales in Philadelphia. He came to Pittsburgh in 1945 as general manager of sales.



25a—General

25a-38. Statistical Summary of Mineral Production (General United States Summary and Detailed Production by States). John Hozik. *1946 Bureau of Mines Minerals Yearbook Preprint*, 1948, 61 pages.

25a-39. The Mineral Industry of Middle and South America. Sumner M. Anderson. *1946 Bureau of Mines Minerals Yearbook Preprint*, 1948, 44 pages.
A statistical compilation.

25a-40. Review of the Mineral Industries of Latin America. Sumner M. Anderson. *Economic Geology and the Bulletin of the Society of Economic Geologists*, v. 43, May 1948, p. 226-231.
Status of bauxite, iron and steel, nickel, copper, lead and zinc, cadmium, gold and silver, and miscellaneous nonmetallic minerals.

25b—Ferrous

25b-58. Tapering Steel Alloy-Element Supply Laid to Unstable World Economics. *SAE Journal*, v. 56, May 1948, p. 37, 47. Based on "Steel and the World We Live In," by Charles M. Parker.
Political and economic considerations involved.

25b-59. The Stamper Looks at His Steel Needs. *Steel Processing*, v. 34, May 1948, p. 239-241.
Surveys prospective needs for sheet and strip steel for various uses.

25b-60. Average Analyses of 1947 Shipments of Lake Superior Iron Ore. *Skillings Mining Review*, v. 37, May 8, 1948, p. 1, 4, 9.

25b-61. Should the Federal Government Subsidize New Steel Capacity in the West? *Modern Industry*, v. 15, May 15, 1948, p. 100-102, 105-106, 108.
A debate between Erwin H. Klaus, publisher of *Western Markets* and Senator Edward Martin of Pennsylvania. Klaus takes affirmative and Martin, the negative.

25b-62. Position of Steel in 1948. W. S. Tower. *Mining and Metallurgy*, v. 29, May 1948, p. 274-277.
Supply and demand situation and future prospects.

25b-63. Mexico's Steel Industry. Carroll E. Plumb. *Electrical Engineering*, v. 67, June 1948, p. 533-534. Essentially full text of A.I.E.E. paper 48-153, "Steel Industry in Mexico."
(To be presented at A.I.E.E. summer general meeting, Mexico City, June 21-25, 1948.)

25c—Nonferrous

25c-40. 32nd Annual Review of the Silver Market. Handy & Harman (New York), 1947, 25 pages.

25c-41. Zinc. Richard H. Mote and Esther B. Miller. *1946 Bureau of Mines Minerals Yearbook Preprint*, 1948, 26 pages.
U. S. and foreign statsitics.

25c-42. Gold and Silver. Charles White Merrill and Helena M. Meyer. *1946 Bureau of Mines Minerals Yearbook Preprint*, 1948, 31 pages.
A statistical compilation covering U. S. and other countries.

25c-43. Cadmium. Richard H. Mote. *1946 Bureau of Mines Minerals Yearbook Preprint*, 1948, 6 pages.
U. S. and foreign statistics.

25c-44. Government Should Carry Copper Stockpile of 6,700,000 Tons for a Future Emergency. Clair Engle. *Metals*, v. 18, May 1948, p. 7-8.
Opinions of a congressman from California.

25c-45. The World Situation in Zinc. (Concluded.) Simon D. Strauss. *Metals*, v. 18, May 1948, p. 9-11.
(Presented at 30th Annual Meeting American Zinc Institute, St. Louis, April 16, 1948.)

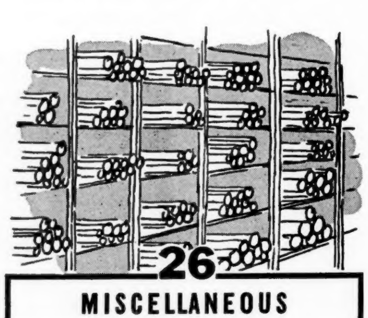
25c-46. U. S. Does Not Need Large Stockpile of Lead; War Effort Would Not Suffer by its Absence. Felix E. Wormser. *Metals*, v. 18, May 1948, p. 12-13.

25c-47. The Competitive Position of Lead. Robert L. Ziegfeld. *Mines Magazine*, v. 38, May 1948, p. 25-26.
Present status and future prospects.

25d—Light Metals

25d-12. A Note on the Japanese Magnesium Industry. *Industrial Chemist and Chemical Manufacturer*, v. 24, April 1948, p. 260-261.
Wartime production and future possibilities.

25d-13. The Indian Aluminum. S. K. Ghaswala. *Light Metal Age*, v. 7, June 1948, p. 16-18.
A statistical review of production at the Aluminium Corp. of India, Ltd.



26a—General

26a-47. Electrochemical and Electrometallurgical Industries. J. W. Cuthbertson. *Reports of the Progress of Applied Chemistry*, v. 31, 1946, p. 306-323.
A review. 111 ref.

26a-48. The New Baillieu Laboratories at Melbourne University. J. Neill Greenwood. *Metal Treatment*, v. 15, Spring 1948, p. 15-16.
Facilities and research programs at above metallurgical laboratory.

26a-49. Compounds of Hydrogen With Metals and Metalloids. Thomas R. P. Gibb, Jr. *Journal of the Electrochemical Society*, v. 93, May 1948, p. 198-211.
Compounds possessing a metal-hydrogen or metalloid-hydrogen bond are classified and their preparation, structure, and properties reviewed briefly. Uses of hydrides. 44 ref. (Prepared for delivery at Columbus, Ohio, meeting of the Society, April 14 to 17, 1948.)

26a-50. How to Maintain and Recondition Lubricants in Metalworking Plants. E. L. H. Bastian. *Steel*, v. 122, May 24, 1948, p. 90-92, 114, 116.
(Presented at General Motors Maintenance Symposium, Detroit, Feb. 12, 1948.)

26a-51. Mellon Institute in 1947-48. *Chemical and Engineering News*, v. 26, May 24, 1948, p. 1518-1523.
Research problems worked on and progress made.

26a-52. New Swedish Metal Research Institute. Erik O. Lissell. *Foundry Trade Journal*, v. 84, May 20, 1948, p. 491-492.

26a-53. Open Swedish Metal Research Institute. Erik O. Lissell. *American Foundryman*, v. 13, June 1948, p. 68-69.
New metal research institute recently opened in Stockholm.

26a-54. Filtration of Insulating Oil Through Adsorbent Materials. E. M. Kipp. *Lubrication Engineering*, v. 4, June 1948, p. 122-124.
Experimental procedure and results to show that such filtration using activated alumina as an adsorbent can extend the useful life of an oil.

26a-55. The Acetylene Cylinder-Industry's Unique Container. Charles Ness. *Welding Journal*, v. 27, June 1948, p. 445-449.
Development of container, which is filled with a porous material to prevent explosion. Methods developed to test safety of the cylinders under unusual conditions such as exposure to flames and high explosives, as well as details of the composition of the filler.

26b—Ferrous

26b-21. Gage of the Future. Gold V. Sanders. *Steelways*, May 1948, p. 32.
Research at Cornell on light-gage structural-steel specifications.

26b-22. Automatic Lubrication of Steel Plate and Sheet Machinery. Francis A. Westbrook. *Steel Processing*, v. 34, May 1948, p. 261-263.
Lubrication systems for various types.

26b-23. Iron and Steel. J. Woolman. *Reports of the Progress of Applied Chemistry*, v. 31, 1946, p. 271-289.
A review. 80 ref.

26b-24. Weirton Steel Company. T. J. Ess. *Iron and Steel Engineer*, v. 25, May 1948, p. 16W-34W.
Layout and facilities. Equipment dimensions.

26b-25. The Grease Phase of Steel Plant Lubrication. C. E. Pritchard. *Institute Spokesman*, v. 12, May 1948, p. 4-11.
Grease phase and types of equipment used in production and finishing and auxiliary thereto. (Presented at the 15th Annual National Lubricating Grease Institute Convention, Chicago, Oct. 16-18, 1947.)

26c—Nonferrous

26c-12. Minerals for Chemical and Allied Industries. A Review of Sources, Uses and Specifications—Part XIX. Sydney J. Johnstone. *Industrial Chemist and Chemical Manufacturer*, v. 24, April 1948, p. 217-223.
Selenium, tellurium, and silica. (To be continued.)

26c-13. Nonferrous Metals. Ernest S. Hedges. *Reports of the Progress of Applied Chemistry*, v. 31, 1946, p. 290-305.
A review. 90 ref.

(Turn to page 58)

Foundry Training Program

A foundry program, combined with the courses in metallurgy, mechanical engineering, and business administration, has been established by Massachusetts Institute of Technology to meet the demands for professional training for the foundry industry. The Engineering Metals, Metal Processing and Foundry Engineering (both ferrous and nonferrous) are some of the courses to be included in the training program. Grants of funds, scholarships and gifts of equipment have been made by both the Steel Founders' Society of America and the Foundry Educational Foundation.

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A. S. M. Ads are limited to 50 words and only one insertion of any one ad. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, Ohio, unless otherwise stated.

POSITIONS OPEN

East

JUNIOR METALLURGIST: Ferrous alloy specialty castings; testing, control, development. New York metropolitan area. Box 7-5.

HEAT TREAT FOREMAN: With five years' experience. For commercial job shop. Box 7-10.

METALLURGISTS OR METALLURGICAL ENGINEERS: Research work in the field of powder metallurgy. Previous experience in this field not necessary, but some in metallurgy desired. Salaries commensurate with background. New York City area. Box 7-15.

METALLURGISTS: Wanted by stable southeastern Pennsylvania firm. Positions include development of procedure, methods, operation of equipment on pilot plant scale, as well as general research in steel and nonferrous alloys. Box 7-20.

TECHNICAL PERSONNEL: For New York area. Positions open include laboratory director, materials director, director of chemical research and development, technical director, assistant technical director, chief engineer, project manager, chemists, physicists, engineers. The Kellex Corp., 233 Broadway, New York 7, N. Y.

SALESMAN ALLOY AND STAINLESS STEEL: Old established steel concern with branch plants in principal cities has opening in Philadelphia area for graduate metallurgist with mill or industrial plant experience or equivalent. Excellent opportunity for young man now working in plant but interested in sales. Previous sales experience not necessary. State age, education, experience, salary expected. Box 7-25.

Midwest

RECENT METALLURGICAL GRADUATE: To work on research and control of thermostatic bimetals. Previous experience not necessary. Please send full information on your background. Also include small photograph. Box 7-30.

TEACHING FELLOWSHIP: In extractive metallurgy at midwestern university. Half time assisting in laboratories and half on graduate studies leading to M.S. or PhD. Box 7-85.

ENGINEER: For manufacturer of precision castings. Supervisory position in charge of all mold design and gating. Experience in this field essential. Unusual opportunity for rapid advancement. Box 7-90.

Government Positions

NAVY DEPARTMENT: Has openings for aeronautical, civil, electrical, electronics, industrial, marine, and mechanical engineers, and for mathematicians, naval architects, physicists and other technical personnel in Washington, D. C. Salaries range from $2975 to $10,330. Some positions involve travel. Applications are available at first or second-class post offices and should be mailed to Code 612, Room 1213, Main Navy Building, 17th and Constitution Ave., Washington, D. C.

ARMY AND NAVY: Announce openings for chemist, metallurgist, physicist, mathematician, and engineers. Salaries $3397 to $5905. Qualifications of applicant determine entering status. Information and application forms may be secured at most first and second-class post offices, from Civil Service regional offices, or from the U. S. Civil Service Commission, Washington 25, D. C.

POSITIONS WANTED

CHEMICAL - METALLURGICAL ENGINEER: B. Ch.E. and M.S. in metallurgy. Eight years' development and research experience. Past four years as group leader. Investigations in chemical metallurgy, welding and foundry practices. Background includes physical metallurgy, powder metallurgy, corrosion, alumino-thermics and detinning. Interested in development or engineering sales in metallurgy or in chemical industry utilizing metallurgical experience. Box 7-35.

METALLURGICAL ENGINEER: B.S. in metallurgical engineering. Age 30, registered professional engineer. Five years' experience in aircraft field and two in nonferrous field embracing administration, production, fabrication, heat treating, powder metallurgy, research and development. Available to metal fabricating or manufacturing firm where initiative, technical ability and enterprise are required. Minimum salary, $4800. Box 7-40.

NONFERROUS PHYSICAL METALLURGIST: B.S. in metallurgical engineering from Carnegie Tech. Two years' experience in copper-base alloy research and development. Desires position with progressive, growing concern. Interested in development, application, or powder metallurgy. Will consider any location, but prefers Midwest or West Coast. Box 7-45.

METALLURGIST: Ferrous. Nineteen years' experience as chemist and metallurgist in large automobile plants. Supervisor of heat treating, metallographic and testing laboratory. Competent metallographer. Extensive investigations of auto parts failures. Familiar with all phases of heat treating. Desires position in production laboratory. Box 7-50.

SALES ENGINEER: Twenty years' experience in stainless, alloy, tool, special steels. College graduate. Industrious, mature judgment. Familiar with manufacturing machinery, hand and machine tools, metal products, sheet fabrications. Knows mill and jobber selling where steel is used. Prefers jobber or small manufacturer in Connecticut area. Box 7-55.

CONSULTANT ON NEW PRODUCTS AND NEW MARKETS: In metallurgical and chemical industries. Available on parttime basis. Extensive experience includes working with both large and small companies. In position to make a complete survey and set up a program for developing new products and markets. Will consider financial interest in the right companies. Pennsylvania, New Jersey, New York, Maryland and Delaware preferred. Box 7-60.

METALLURGIST: Recent University of Illinois graduate is interested in production, sales or research metallurgy. Box 7-65.

INSTRUMENT MAKER: Research, experimental or job work. Prefers research and development with facilities for carrying an idea through to production. Nine years' experience in making special instruments and tools. Box 7-70.

METALLOGRAPHER: Fully trained and experienced for high caliber workmanship and interpretation. Presently in charge of metallography department which handles almost all types of material and metallographic problems. Age 36. Box 7-75.

METALLURGICAL ENGINEER: June 1948 graduate with M. Met. E. from Rensselaer Polytechnic Institute desires position in research, production or teaching in Chicago area. Age 23, Navy veteran. Thesis on investigation of isothermal transformations and hardenability of steel. Two years' experience instructing college chemistry. Personable, energetic, industrious. Box 7-80.

MELTING SUPERINTENDENT: Electric furnaces. Ten years' experience as melter and 10 years' as superintendent of melting department. Has worked with carbon, alloy, high speed, stainless and heat resisting steels. Seeking relocation. Box 7-95.

METALLURGICAL ENGINEER: B.S. Fully trained for position in production, quality control, development and research. Acquainted with the metallurgical problems related to high speed and carbon steels, heat treatment, and physical and metallographical testing of metal materials. Desires position in the Eastern states. Box 7-100.

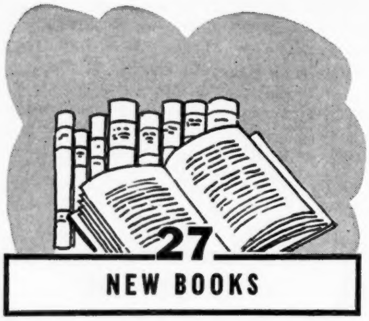
METALLURGICAL ENGINEER: Age 31. B.S. and some graduate credit; additional training in industrial management. Desires administrative or educational position. Experience includes 2½ years as materials engineer; five years' administrative experience as Army Ordnance officer in procurement, supply, and training; 1½ years teaching physical metallurgy (assistant professor). Minimum salary $5000. Box 7-105.

CHEMICAL ENGINEER: Research executive. Age 40, married, one child. Pharmacy, chemical engineering and metallurgy academic training. Twenty years in production, control and research of flake metallic powders. Past three years, a director of research. Box 7-110.

REPRESENTATIVE AND SALES ENGINEER: For nonferrous industry on West Coast. Eighteen consecutive years experience —executive, sales, and engineering. Good references. Box 7-115.

INDUSTRIAL ENGINEER: B.M.E. Age 27, married. Experienced in drafting and design, production methods, time study, machine shop practices, and research. At present, production engineer at an atomic research plant. Desires management position with cost-minded progressive industry. Well trained in business administration. Will give complete data and references upon request. Box 7-120.

RESEARCH METALLURGIST: M.S. in metallurgy. Age 28, married. Two years in engineering material laboratory. Most research projects in welding of stainless steels. Desires position in or near Cleveland or Pittsburgh. Box 7-125.



27a—General

27a-79. Quin's Metal Handbook and Statistics—1947. F. B. Rice-Oxley, compiler. 452 pages. 1948 Metal Information Bureau, Ltd., Princes House, 39 Jermyn St., London, S.W.1, England.

Statistics, and standard classifications and conditions of sale for nonferrous scrap metals.

27a-80. Rubber to Metal Bonding. S. Buchan. 239 pages. 1948. Crosby Lockwood & Son Ltd., London, England.

Process utilizes brass plating as a bonding agent in the manufacture of rubber-metal units. Plating procedures, cleaning solutions, natural and synthetic-rubber compounding, mechanism of the rubber-to-brass bond, and use of nonbrass bonding cements.

27a-81. Metallurgical Materials and Processes. John Elberfeld. 188 pages. 1948. Prentice-Hall, Inc., 70 Fifth Ave., New York, N. Y.

General background in science of metals. Grain structure; constitution diagrams; heat treatment furnaces and their controls; forming of metals; welding metallurgy; powder metallurgy; and laboratory procedures.

27a-82. Stress Analysis and Design of Elementary Structures. Ed. 2. James H. Cissel. 419 pages. John Wiley and Sons, Inc., 440 4th St., New York, N. Y. $5.00.

Primarily intended to give a working knowledge of fundamental methods in structural design to engineers, architects, and students not specializing in the field.

27a-83. Bibliography on Wire (Manufacture, Treatment, and Properties), Including References to the Cold-Drawing of Bars. 146 pages. Iron and Steel Institute, 4, Grosvenor Gardens, London, S.W. 1, England.

An extremely careful compilation of the literature on wire drawing. Covers the period up to, and including, 1946, but on the earlier work only the more important references are given. One section deals exclusively with dies and their attendant problems. (From review in *Industrial Diamond Review*, New Series, v. 8, May 1948.)

27a-84. Directory of Machines, Apparatus and Tools. Ed. 14. 1947. Bureau de Documentation Industrielle, Hugo Buchser, Geneva, Switzerland.

Precision engineering, apparatus, instruments and tools. A companion volume to the guide for the watch industry. Indexes in five different languages: English, French, German, Spanish and Italian. (From review in *Industrial Diamond Review*, New Series, v. 8, May 1948.)

27a-85. Transactions of the Electrochemical Society. v. 91. 723 pages. 1947. The Society, Columbia University, New York, N. Y.

Directory of officers, committees, divisions of the society, and local sections of the society. Society awards and titles of winning papers. Minutes of the 91st general meeting of the Society held at Louisville, Kentucky, April 9, 10, 11, and 12, 1947. Technical papers presented at this meeting, which have been previously abstracted from preprints when of metallurgical interest.

27a-86. Magnetic Materials. F. Brailsford. 156 pages. Methuen & Co., Ltd., London, England. 6s net.

A comprehensive outline of the present state of knowledge of the subject. Ferromagnetism; the properties and theory of single crystals; some factors affecting magnetic properties; iron and silicon-iron alloys; nickel-iron and other alloys; and permanent magnet materials.

27a-87. Applied Physics: Electronics; Optics; Metallurgy. C. G. Suits, George R. Harrison, and Louis Jordan, editors. 456 pages. 1948. Little, Brown and Co., Boston, Mass. $6.00.

Volume in the series "Science in World War II" reports to the public the work done by the Office of Scientific Research and Development. Operational use of radar countermeasures in the war. Second section deals with optical instruments of all kinds: cameras, binoculars, light and heat detectors, and camouflage. Third section describes specific fields of metallurgical research and participating agencies. Work done on aircraft metals, armor, guns, metals for particular services, and an examination of enemy materiel.

27a-88. Fundamentals of Stress Analysis. Vol. 1. Albert Deyarmond and Albert Arslan. 356 pages. *Aero Digest*, Book Dept., 515 Madison Ave., New York 22, N. Y. $3.50.

Based on a course of study taught by the authors under the National Defense Training Program, it is intended to provide the student with a practical understanding of the principles of stress analysis. Background of knowledge regarding types of structures, types of stresses and strains, forces and couples, and the laws of statics; structures with axial loads in the members, stresses in beams, torsional stresses, section properties and allowable stresses. (From review in *Aero Digest*, v. 56, June 1948.)

27a-89. Vibration in Machinery. W. A. Tuplin. 111 pages. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London.

Presents the subject with a minimum of mathematics. Multimass systems, vibration-exciting influences, torsional and transverse vibration, and reduction of vibration stresses at critical speeds. Use of flexibility to diminish vibration and measurement of vibration. Machinery failures due to vibration. (From review in *Machinery* (London), v. 72, May 20, 1948.)

27a-90. Sbornik Dokladov po Dinamicheskoi Prochnosti Detalei Machin. (Collection of Reports Concerning Dynamic Strength of Machine Parts.) 253 pages. 1946. Academy of Sciences of the U.S.S.R., Moscow and Leningrad, Russia.

Eighteen reports presented at a meeting of the Institute of Machine Technology and the All-Union Scientific Engineering-Technical Association for Machine Construction, held in May 1941. Theoretical and practical aspects of design and stress analysis. Abstracts of some of the individual papers also appear in this issue.

27a-91. The Modern Metallurgy of Alloys. R. H. Harrington. 209 pages. 1948. John Wiley & Sons, Inc., 440 4th Ave., New York, N. Y.

Correlates modern theory with practical data, including the fundamentals of a new field of alloy treatments.

27a-92. Metals Handbook. 1948 Edition. Taylor Lyman, Editor. 144 pages. American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. $15.00.

This almost completely rewritten version of the A.S.M. Metals Handbook contains an array of facts indispensable to those in the metallurgical field. While many tables and diagrams are included, most information is presented in the form of articles stressing fundamental and essential aspects of various subjects. Main divisions of the book include a General section dealing with shaping of metals, welding, mechanical testing, nondestructive inspection, heat treating, surface treatments, structure and properties of metals and like topics; a Ferrous Metals section in which (among other topics) manufacturing, shaping, alloying, testing, hardening of the stainless, tool, and other steels and irons are discussed; a Nonferrous section containing data on properties, manufacturing and fabricating methods for all of the nonferrous metals and their alloys; and a concluding section of phase diagrams of the alloy systems. A complete index makes the information in the Handbook readily available.

27b—Ferrous

27b-32. U.S.S. Carilloy Steels; Alloy Steels for the Special Jobs of Industry. 176 pages, Carnegie-Illinois Steel Corp., Pittsburgh. 1948.

Effects of alloying elements on the microstructure and properties of steel; hardenability; mechanical properties of alloy steels; practical heat treatment; principal applications of constructional alloy steels.

27b-33. Handbuch der Sonderstahlkunde. (Handbook of Special Steels.) Eduard Houdremont. 1036 pages. 1943. Springer Verlag, Berlin, Germany. Reprinted by Edwards Bros., Inc., Ann Arbor, Mich.

Study of carbon and alloyed steels. Crystallographic properties and uses of pure iron. Low, medium, and high-carbon steels, their structures, transformations, and property changes induced by heat treatment and mechanical working. The effects of alloying elements.

27b-34. Schweissen der Eisenwerkstoffe. (Welding of Ferrous Materials.) K. L. Zeyen and W. Lohmann. 456 pages. Verlag Stahleisen, Dusseldorf, Germany.

Metallurgical problems of welding. Correct application of the fundamental laws of metallurgy is essential for successful welding. Destructive and nondestructive tests, and the influence of the microstructure of the different zones of a weld on mechanical properties.

MANUFACTURERS' LITERATURE

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4-page catalog features new model 223 bar cutter west abrasive cutting machine. Included are pictures of machine, both interior and exterior and closeups of the cutting action. Machine will cut 2″ diameter solid stock and 3½″ tubing. Andrew C. Campbell Div., American Chain & Cable Co.

62. Analysis, Electrolytic
Fully illustrated 6-page leaflet discusses application of high speed methods of electrolytic analysis of vital metallurgical products. Sargent-Slomin analyzer and its precision results are described. E. H. Sargent & Co.

63. Blowers
4-page folder G-82 illustrates entire line of centrifugal and rotary positive blowers and inert gas generators. Roots - Connersville Blower Corp.

64. Carbide Tools
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67. Fabrication, Light Metals
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68. Forgings
Numbers 1 and 2, Volume 10 of "Forgings" features the farm and petroleum fields. Many illustrations and interesting material on forgings for these industries are shown in an attractive manner. Kropp Forge Co.

69. Furnaces, Heat Treating
8-page booklet illustrates gas, oil and electric heat treating and carburizing furnaces. Holcroft and Co.

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73. Magnesium
16-page May issue of "Magnesium" contains interesting articles on weight-saving, military uses, check list for designers and many illustrations. Brooks & Perkins, Inc.

74. Metal for Industry
Colorful 24-page booklet outlines the operations of the units of this company in the processing of metals in combination with other metals to make a wide range of alloys, to design and produce tools, dies and stampings, make tool steel, weave metal cloth, and shear and slitter knives. Continental United Industries Co., Inc.

75. Metals, Plated
20-page illustrated booklet G features use of preplated metals. Hundreds of products are shown. Physical properties, tempers are given. American Nickeloid Co.

76. Metal Sawing
16-page booklet unique engineering experience embodied in line of four basic circular sawing machines for cutting stock from ¼″ to 16½″, all utilizing the advantages of the triple-chip saw blade in diameters from 8″ to 45″, with correct automatic sharpeners to grind all blade sizes. Motch & Merryweather Machinery Co.

77. Metallurgical Products
84-page catalog No. 1 covers products of this company, including various special metals and alloys, line of special metallurgical products and welding tips and holders. P. R. Mallory & Co.

78. Nickel
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4-page leaflet describes complete facilities for producing powder metal parts of all kinds, with porosity or density controlled to meet specific requirements. Michigan Powdered Metal Products Co. Inc.

81. Perforating
Catalog 47 gives details and facts about unit for perforating holes up to ½″ in diameter in materials to 1/16′ thick mild steel. S. B. Whistler & Sons, Inc.

82. Polariscopes
Bulletin 143-74 on photoelasticity polariscopes describes apparatus used for obtaining experimental solutions to problems of stress distribution in mechanical parts and structures. Gaertner Scientific Corp.

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Fatigue Is Still A Problem in Bearing Metals

Reported by R. F. Thomson
International Nickel Co., Inc.

On May 10 (when special honor was paid to the Toledo Group) the Detroit Chapter listened to a talk on "Bearing Metals and Their Lubrication" by A. F. Underwood of General Motors Corp., research laboratory division. The talk was illustrated with an exceptional group of colored slides and a colored movie showing the behavior of the oil film in bearing lubrication. W. E. McCullough, Bohn Aluminum and Brass Co., served as technical chairman.

Fatigue in bearing metals was a problem 20 years ago, Mr. Underwood pointed out, and still is, although much has been learned in this period. Selection of a bearing material, usually requires a compromise because no single material gives maximum properties for all conditions.

One of the earlier theories which has been fairly well disproved is that a successful bearing material must possess hard particles embedded in a soft matrix. In fact, in Cu-Pb bearings, there are soft particles in a hard matrix and in the silver bearing there is a homogeneous structure.

Mr. Underwood rated the various bearing materials according to the following general rules:

1. The resistance to scoring increases with increasing lead content, with white metal bearings showing good properties.

2. Compressive strength is roughly inversely proportional to nonscoring qualities.

3. Fatigue strength decreases in the following order: Bronze, silver, aluminum alloys, lead bronze, thin overlays, Cu-Pb, cadmium alloys and babbitts.

4. Conformability is, in general, inversely proportional to fatigue strength.

5. Corrosion resistance is best in the Al, Sn, babbitt, Cd-Zn, bronze (low lead), and silver bearings; intermediate in bronze (high lead) and Cu-Pb and poor in the cadmium bearings.

The "new look" in bearing selection is toward: (*a*) the thin overlay type such as the Cu-Ni powder overlaid with lead-base babbitt; (*b*) the aluminum bearing (which carries the possibility of integral connecting rod and bearing; (*c*) the composite steel + Cu-Pb + Pb babbitt; (*d*) the sintered Cu-Pb bearing; and (*e*) the grid bearings, of either Cu or Ag with lead-filled interstices.

An excellent coffee talk was presented with the help of J. Bullock of the Program Committee. He introduced Mahatma Kleri who gave his personal views in some unintelligible dialect on world affairs as seen from Bombay, India, with Mr. Bullock serving as interpreter. Unfortunately the Mahatma tried to drown himself with drink during the dinner and it became apparent to all that the imposter was none other than R. C. McCleary of Chrysler Corp. (The drink amounted to seven pitchers of ice water!)

E. Stilwill, retiring chairman, gave a brief farewell message in which he expressed his appreciation to all who had contributed to the Detroit Chapter during the past year.

Retired Director of G. M. Lab Dies at 73

Frank O. Clements, 73, first director of the General Motors Research Laboratories, died May 8 at his home in Westerville, Ohio, where he had lived since he retired from the laboratories eight years ago.

Dr. Clements was graduated from Otterbein College and took work at Ohio State University, where he met Charles F. Kettering. In 1904 he became chief chemist of the National Cash Register Co. Twelve years later he was invited by Kettering to become technical director of the famed inventor's laboratory at the Dayton Engineering Co. After World War I, when the laboratory and personnel were taken over by General Motors, Dr. Clements remained as director.

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For the 30th

NATIONAL METAL CONGRESS & EXPOSITION

PHILADELPHIA COMMERCIAL MUSEUM and CONVENTION HALLS

Metal Exposition Opens Monday, October 25 to Friday, October 29

(Certain Technical Sessions Will Be Held Saturday and Sunday, October 23 and 24.)

Extensive plans are being completed to provide interest during your visit to the 30th National Metal Congress and Exposition. You won't want to miss this outstanding technical program and metal show. In view of the large number planning to attend, we urge you to order double rather than single rooms and plan joint reservations so as to occupy all double rooms and twin-bedded rooms to capacity.

Cooperating Societies and Hotel Headquarters

American Society for Metals—Benjamin Franklin . . . American Welding Society—Bellevue-Stratford . . . Institute of Metals Division, American Institute of Mining and Metallurgical Engineers—Adelphia . . . Society for Non-Destructive Testing—Benjamin Franklin.

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Member of A.S.M. ☐ A.W.S. ☐ A.I.M.E. ☐ S.N.D.T. ☐

IMPORTANT: Assignment of rooms will be made by the Housing Bureau beginning **August 1st, 1948,** BUT NOT EARLIER. As soon as possible thereafter you will receive confirmation direct from the Housing Bureau. Duplicate will go to the hotel accepting reservations.

A Salute to ALLOY STEEL

AS THE CENTRAL THEME OF THE 30TH NATIONAL

METAL CONGRESS & EXPOSITION

PHILADELPHIA - OCTOBER 25 - 29, 1948

Alloy Steel has assumed such a tremendous role of such primary importance in so many essential industries, that the American Society for Metals welcomes this opportunity to dedicate as the theme of the 30th National Metal Congress & Exposition — "A Salute to Alloy Steel".

Alloy Steel is a truly American achievement. Since the tremendous improvement in Alloy Steel during the past 30 years has paralleled the growth and importance of the American Society for Metals, it is fitting that the 20,000 members of this society, who represent the Alloy Steel producing and consuming industries, should sponsor this well-deserved tribute.

BRILLIANT TECHNICAL PROGRAM

A vast panorama of progress in Alloy Steel production and fabrication will be presented at the Philadelphia Metal Congress & Exposition. A brilliant program of over 100 stimulating and helpful technical papers on all aspects of Alloy Steel will be presented by recognized authorities at the Metal Congress.

DISTINGUISHED SERVICE AWARDS

An outstanding feature of this diamond jubilee of Alloy Steel will be the presentation of "Distinguished Service Awards" to individuals who, by research, improved manufacturing processes, experimentation, new applications and various other means, have contributed to the improvement, development and acceptance of Alloy Steel. Nominations for these awards will come from the entire metal industry and will be judged by a special Awards Committee of top-ranking executives.

THE DRAMA OF ALLOY STEEL

Along with the distinguished displays of over 350 manufacturers and processors of metals and metal products will be a spectacular dramatization of the 75 years progress in Alloy Steel. Occupying the entire stage of Convention Hall, this exhibit will give visitors to the Exposition the complete story of Alloy Steel.

From all over the nation, metal men are making plans to come to Philadelphia for this great jubilee. Don't miss it—make your arrangements TODAY!

Sponsored by the American Society for Metals in co-operation with the American Welding Society, the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, and the Society for Non-Destructive Testing.

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